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Presented by:

Transition Analysis Component Technology, Inc. (TACTech)
22700 Savi Ranch Parkway
Yorba Linda, CA 92687
(714) 974-7676

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David L. Troutt

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
(TACTech)
Transition Analysis Component Technology, Inc.
22700 Savi Ranch Parkway
Yorba Linda, CA 92687

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Obsolescence is an increasing problem facing every weapon system in the Department of Defense. Cutbacks in defense spending have resulted in the need to keep currently fielded systems operational for longer periods of time than originally planned. Obsolescence of the components used to maintain these aging systems is resulting in reduced mission readiness. This research project explores where and how obsolescence is effecting weapons systems, what factors drive obsolescence, and how those factors can be used to predict obsolescence problems so that preemptive measures can be taken. An evaluation of currently available automated tools is included as well as a preliminary design of a computer-aided obsolescence prediction system.

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Section 1

1.1 Introduction

Obsolescence is an increasing problem facing every weapon system in the Department of Defense. Cutbacks in defense spending have resulted in the need to keep currently fielded systems operational for longer periods of time than originally planned. Obsolescence of the components used to maintain these aging systems is resulting in reduced mission readiness. This research project explores where and how obsolescence is effecting weapons systems, what factors drive obsolescence, and how those factors can be used to predict obsolescence problems so that preemptive measures can be taken. An evaluation of currently available automated tools is included as well as a preliminary design of a computer-aided obsolescence prediction system.

1.2 Summary

When it is no longer economical to produce a component and there are no viable alternatives, that component is considered to be obsolete. Obsolescence is but one driving component of a larger problem facing the Department of Defense, Diminishing Manufacturing Sources and Material Supply, (DMSMS).

Factors that cause a manufacturer to stop producing a component include market changes, material shortages, loss of processing capability, and loss of required skills. But one manufacturer stopping the production of an item is NOT considered by the above definition to be obsolescence unless it is also uneconomical for all other manufacturers to produce the component. The factors that drive obsolescence are the item's inherent complexity, the rate at which the technology that goes into producing the part is changing, the rate of technological change in the environment in which the item is utilized, and how widely used the item is outside of the military.

The obsolescence vulnerability of a component is directly related to the cost to re-create the component. Practically any item can be re-created given enough time and money with very few exceptions. Even today's most sophisticated microprocessors are being duplicated by competing firms although at the cost of millions of dollars. Factors found that make a component more costly to re-create include the process uniqueness, the amount of capital equipment required, proprietary designs, and regulatory limitations.

The research conducted in this study found that electronic components without exception had the greatest vulnerability to obsolescence. A ratio of 400 to 1 was found between the

number of obsolescence problems found in electronic components as compared to mechanical components.

The Department of Defense has many innovative projects underway that are attempting to track, solve, and project obsolescence and broader DMSMS problems within currently deployed weapon systems. These programs are fragmented and being developed with little or no coordination resulting in the duplication of efforts across many military commands. However many of the programs have developed new and creative approaches to tracking and solving DMSMS problems. Various programs are also taking different approaches to solving obsolescence problems such as a looking at the program level, versus the individual component level.

Predicting obsolescence based on the factors mentioned previously involves monitoring trends, both internal and external to the Department of Defense. These trends include economic markets, environmental regulatory statutes, manufacturer financial health, and manufacturer product lines. Connecting these trends to the components used by the Department of the Defense is essential for assessing the impact of obsolescence upon individual weapon systems. Making this connection is a costly and difficult process. An example of how to make this connection is provided in Section 1.3. Some trends that are making the connections more difficult to determine are NDI (Non-Developmental Items) and COTS (Commercial Off The Shelf). Both NDI and COTS remove essential visibility into the materials and processes by which an item is created. The move away from military specifications and towards performance specifications is also having a similar impact.

Computer automation is the key by which obsolescence prediction can be accomplished in a timely and economical way. This research proposes a pilot project that includes three key computer automation concepts that should be employed. The concepts are concentrating the data into a central source, making the data easily accessible from any location, and integrating the process directly into existing work patterns. The functions that a computer-aided obsolescence predictive tool should provide are tracking of historical obsolescence impacts on a component, automated monitoring for future impacts, integrated data access, shared information among multiple commands, obsolescence vulnerability analysis, easy to use research tools, and a case management system.

To reduce the costs of creating and maintaining a computer-aided obsolescence predictive tool, it is recommended that future development focus on component categories with the highest instance of obsolescence. These categories are integrated circuits, diodes, transistors, electronic tubes, and connectors. By focusing on these

categories, an estimated 80% of obsolescence problems will be covered while limiting the data gathering to a cost effective level.

The proposed pilot project would also utilize COTS (Commercial Off The Shelf) hardware and software and employ an open systems architecture that would allow for seamless scaling to larger systems so it could eventually be used across the Department of the Navy. It would utilize advanced DMSMS systems already in use at two different Naval installations as an architectural foundation. The predictive obsolescence tool would be added to this foundation. The tool will incorporate a judicious use of artificial intelligence in the form of rule based and natural language processing systems. A centralized data repository would be created and data for a test platform would be entered from various internal and external resources as well as commercial data suppliers.

The successful testing of the predictive tool on a currently deployed weapon system would pave the way for implementation across the navy to multiple weapon platforms.

This research project was conducted over a six month period and involved site visits to many Navy commands, DoD agencies, military contractors, and commercial component manufacturers. These site visits provided the means to obtain a first-hand understanding of obsolescence, the factors that drive it, the impact obsolescence has upon Naval weapon systems, the current computer-aided tools that are being utilized, and those that need to be created. These site visits are the basis for the conclusions and pilot project design in section 1. Section 2 details each site visit and the findings from that visit.

1.3 Findings

1.3.1 DMSMS and Obsolescence

Although the original SBIR request (N93-180) never mentions the acronym DMSMS (Diminishing Manufacturing Sources and Material Shortages), it is mentioned throughout this document. DMSMS has become a standard term within the U.S. military and is commonly used interchangeable with the term obsolescence. DMSMS is defined by the Office of the Secretary of Defense as:

> Loss or the impending loss of manufacturers or suppliers of items or shortages of raw materials.

Obsolescence is defined for the purposes of this research study as:

> A component is obsolete when it is no longer economically feasible to produce it and no viable substitute is available.

Obsolescence is really a factor of DMSMS since it is just one of the reasons that a part may become unavailable to the military. Some of the most pressing problems facing the U.S. Military today fall under the broader definition of DMSMS. This research study is focused on the possibility and the feasibility of developing computer-aided obsolescence prediction tools and how these tools can be incorporated into effective DMSMS management systems.

1.3.2 What is a Component?

A component is a part that has no sub-components. For example, a bell-crank for the control surface of an aircraft may be milled out of a solid piece of aluminum and have a bearing assembly attached to it. The aluminum bell-crank is a component as well as the bearings, retaining rings, the coatings on the bearings, and lubricant of the bearing assembly.

Axiom: An assembly's vulnerability to obsolescence is equal to the greatest obsolescence vulnerability of any one of its components.

Axiom: Alternate manufacturers are NOT a solution but only a stop-gap measure for an obsolescence problem component. Most likely the conditions that causes one manufacturer to stop producing a component will also impact the alternate manufacturer at some point in the future. One exception is when the demand from the DoD is great enough to warrant the remaining manufacturer to continue production after the commercial market has declined.

1.3.3 The Basis of Obsolescence

A component becomes obsolete when it is no longer economically feasible to produce that component. It is very rare that given enough time and money that an item can not be created. An exception would be a Stratavarious violin or the Hope Diamond. Even the most sophisticated microprocessor with over one million transistors can be recreated as proven by Cyrix, Inc. and the Intel 80486. Thus, the key to projecting the discontinuance of a component or its obsolescence vulnerability is based upon the economics of producing it.

For example, if a water pump manufacturer has discontinued a particular pump and more are needed, then the question is no longer whether another pump can be created to meet the original's design specifications. The question then becomes can the pump be created for an economical price, or should the weapon system be redesigned to make use of another pump?

1.3.4 What makes a component too expensive to re-create?

The economics to produce a component can change for several reasons. These reasons are:

Market Changes -- If the profit margin declines due to competitors or shifts to newer technologies, the manufacturer will no longer be able to justify continuing to produce older components.

Material Shortages -- Lack of available raw materials can drive the price of the finished product beyond what is considered reasonable. These shortages can be due to such factors as actual lack of material availability or regulatory changes that make the raw material illegal to produce. An example would be chemicals containing PCB's (found is some older transformers and capacitors).

Loss of Processing -- The loss of or the unavailability of processing equipment can result in obsolescence. An example would be an integrated circuit manufacturer that replaces its older processing equipment. The new equipment is not capable of creating the older technology integrated circuits and thus the manufacturer loses the ability to produce the older integrated circuits.

Loss of Skills -- Loss of key personnel with the unique knowledge of manufacturing techniques can result in the inability to manufacture some items.

1.3.5 Why not have someone else make it?

Difficulty in manufacturing a component can be due to any combination of the following factors:

Process Uniqueness -- A process may be unique to a particular manufacturer. The more complex or sophisticated the component, the more likely process uniqueness plays a role in raising the costs of reproducing the part.

Capital Equipment -- Capital equipment needed to produce the component may not be available at another manufacturer's site. An example would be the test firing facilities of a manufacturer for the Titan rocket engines.

Proprietary Designs -- Designs that are proprietary may not be available to other manufacturers. This is a more prevalent factor for commercially available components that the DoD has procured for use since these component were not designed by the DoD.

Regulatory Limitations -- Changes within environmental laws have made many chemicals and materials unobtainable.

Each component should be analyzed as to its susceptibility to each of the above factors in order to predict its potential obsolescence.

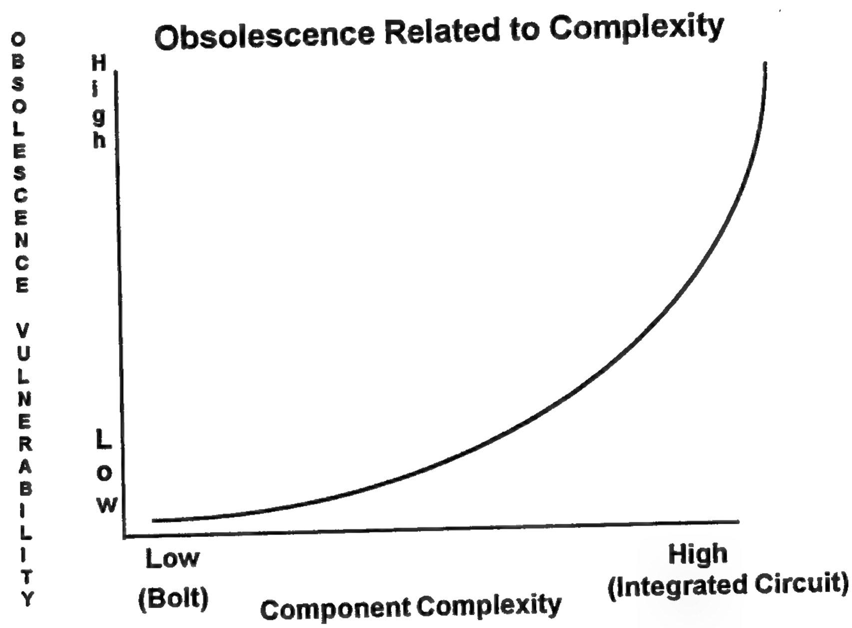


Figure 1
Relationship of Complexity to Obsolescence

1.3.6 What makes a component vulnerable to obsolescence?

What makes one component more vulnerable than another to obsolescence? A core set of common factors determine the vulnerability of a component to become an obsolescence problem. These factors are:

Complexity -- The more complex the component, the more likely it will become an obsolete (See Figure 1). For example, a component such as an integrated circuit is vastly

more complex then a steel bolt, the ability to find a substitute or to re-create the circuit is much more difficult and expensive than it would be for the bolt. This relationship of complexity to obsolescence was pointed out by Rick Cassidy of National Semiconductor (See Site Visit Report, Section 2.1.19, as well as research conducted at DESC, DISC, and DCSC, Site Visit Reports, Section 2.1.6, 2.1.7, and 2.1.4 respectively).

End-Item Technology Transitions -- The faster the component's technology changes, the greater the likelihood that the component will become obsolete. For example, fastener technology (bolts, nuts, nails, clips, etc.) changes very slowly as compared to the technology of adhesives and bonding agents.

Process Technology Transitions -- The faster the technology changes in making the component, the more likely the component will become unavailable due to the lack of processing equipment. Integrated circuits are again a prime example. By today's standards, old RTL and DTL components were made on antiquated fabrication lines. These lines are no longer available since rapid technological change has forced the replacement of older lines in order for manufacturers to remain competitive.

Military Specific -- The more a material or component is specific to the military (not available readily on the commercial market) the more vulnerable the it is to obsolescence. If a material or component is widely used by the general industry, there will be enough demand that someone will continue production or there will be the development of an acceptable substitute. CFC's is an example. The EPA's restriction of CFC's demonstrated this concept. Since CFC's were not only used by the military but also the general public, new environmentally safe coolants were developed.

As with any set of factors or generalizations, exceptions can always be pointed out. However, upon closer examination, whatever is unique about the component will most likely fall into one of the above categories.

1.3.7 What are the problems faced today?

1.3.7.1 Component Types with the Greatest Problem and Why

Without exception, every DoD agency and contractor visited stated that electronic components were the greatest problem in both cost, and quantity of discontinuances. Electro-mechanical parts such as relays, switches and circuit breakers were seen as the next biggest problems for the military programs. At the other extreme according to

DISC, simple mechanical parts have almost no obsolescence problems, (See Site Visit Report, Section 2.1.7). The reason that electronic components have the greatest vulnerability to obsolescence is that they are usually complex in nature, proprietary in design, and the technology used to manufacturer them is changing very rapidly. Also, the technology of the devices that use the electronics are changing at a very rapid pace. These factors combine to create extraordinary market pressures for manufacturers to keep up with these latest changes or lose market share and eventually be put out of business.

1.3.7.2 Current Status of DMSMS Tools

Because DMSMS management systems are in their infancy and funding flow has been thin, the systems currently in operation have little if any predictive tools and are for the most part poorly integrated into their environment (See Section 2.2 for a detailed write-up of the systems surveyed). However, work is currently underway to expand many of these systems. These expansions include the movement to a Graphic User Interface (GUI), connectivity to other organizations, the integrating of additional data sources, and tracking/analysis tools.

The systems at HONE (See Site Visit Report, Section 2.1.11), NSWC Port Hueneme (See Site Visit Report, Section 2.1.22), and the system at NUWC Keyport Washington (See Site Visit Report, Section 2.1.23) are examples of the more robust DMSMS management tools. Each of these systems have unique capabilities not possessed by the other. Keyport's system has a detailed case tracking and management module, while Port Hueneme's system monitors for potential problems from a variety of areas, but does not have a DMSMS case management system. HONE's system has a 'big-picture' perspective lacking in the other two systems but it lacks the ability to track and monitor obsolescence at the component level. Integration of the design strengths of each of these tools into a single system would create a more complete DMSMS management tool.

Obsolescence prediction is one aspect missing from most of the tools surveyed during the site visits. However, a few sites did attempt to incorporate some form of prediction into their systems. NUWC, Keyport, Washington incorporated the life cycle projection model data from TACTech for electronic components (See Predictive Tools Survey Review, Section 2.2). The Health model from NSWC, Port Hueneme will be incorporating TACTech's data as well. Most of the systems focused on electronic components due to the large number of obsolescence problems. The Health model does make provisions for other types of components, but as of yet has not made the 'connection' to materials and processes.

Rockwell International in Downey California is an exception. It does focus on non-electronic parts and has made the connection to processes and materials. Its materials obsolescence prediction model is oriented towards determining the amount of an obsolescence threat than a predicted time frame.

One aspect lacking in all the systems observed is a closed loop between the various activities of procurement, repair, design, and operations. The Health model from NSWC, Port Hueneme has immediate plans to close this loop to a degree by automatically incorporating new information from design activities. Thus as changes to the design take place due to modernization or DMSMS case solutions, the Health model's monitoring system will have its parts lists automatically brought up to date.

Tracking of repaired items, items in stock, and exact items usage over time is difficult due to the fragmented nature of the Navy's procurement and repair activities. The accuracy of where a component is used and how often the component is replaced is poor due to the lack of an effective coordinated tracking system across multiple commands and departments (See Site Visit Report, Section 2.1.8). This lack of timely, accurate data combined with the lack of a 'big-picture' perspective results in miscalculations of life-of-type-buys (The last procurement of the number of components required to keep a weapon platform operational to the end of its designed life).

1.3.8 Predicting Obsolescence

Predicting the obsolescence vulnerability for a variety of components requires an analysis on a per item basis. The analysis must isolate those elements that will directly influence the availability of the materials and processes that go into creating the component.

1.3.8.1 Economic Market Influences

Predicting obsolescence problems for a given component is highly dependent upon whether a commercial market exists directly or indirectly for that component. The more that a component is designed and built to government specifications the more isolated the component is from a commercial market. Thus, a component fits into one of four categories:

Commercial Off-The-Shelf (COTS) -- There is a direct commercial equivalent for the component used by the military. Therefore as long as a commercial market exists for the component, the manufacturer has reason to maintain the ability to produce the military equivalent. For this

type of component, predicting obsolescence involves the analysis and tracking of the commercial market and identifying trends within that market.

Non-Developmental-Item (NDI) -- An NDI type of component is one that has a commercial root equivalent, but has been modified to meet a military specification. NDI includes a range of possibilities from simple color changes to design changes. To predict future obsolescence, monitoring of commercial market trends is still necessary as well as periodic communication with the manufacturer as to their continued ability to make the modified part. Military electronic components fit into this category of parts.

Specified -- Specified components have no commercial equivalents. These components are strictly created for a military contract. The availability of these components is heavily reliant upon the manufacturer's continued financial health and thus may or may not be influenced by commercial market trends. Therefore, an analysis of percentage of sales and income from the commercial market versus the military market is needed to ensure future availability. The greater the percentage of commercial sales and income the more important commercial market trends become. Additionally, this analysis should be done at the facility level if production of the specified component is highly reliant upon specialized manufacturing equipment. An analysis of other military procurement projections should also be done to ensure that enough military production will take place at the facility to keep the manufacturer financially stable.

In-House Production -- One exception to the need to monitor the commercial market is an item that is produced at a DoD facility. Obsolescence vulnerability for this type of a component is based upon the availability of raw materials, chemicals and materials used in the production, and the availability of the manufacturing equipment. Further analysis into the life expectancy of the manufacturing equipment should be conducted.

1.3.8.2 Monitoring Market Trends

Almost every market has its industry forecasters. For electronic components, sources such as Integrated Circuit Engineering (ICE) and DataQuest collect data and produce annual reports of the industry's trends and directions. Other industrial markets have their own market research and forecasting organizations that one can usually find by reviewing periodicals for that industry.

Government databases such as MPCAG track the design-in of newly developed technology. Trends in the type of

technology being utilized for new designs can be extracted from this type of data. Still another source of market trends are industry trade journals and publications. These publications periodically provide forecasts and trends within news articles.

1.3.8.3 Regulatory Influences

State and Federal government agencies such as the EPA and OSHA continuously create new and more stringent regulations for processes and materials that are considered hazardous. Therefore, many of the materials commonly used in both the military and the commercial industry are becoming highly regulated. As regulations increase, this reduces the feasibility to produce a component at a reasonable price. Manufacturers then either turn towards other manufacturing processes that may or may not meet the original performance specifications, or the processes move to off-shore manufacturers which are under less stringent regulations. In either case, a high probability exists that the original component could face obsolescence.

1.3.8.4 Monitoring Regulatory Trends

Rockwell International, Downey, California is working with the NASA Operational Environment Project in Huntsville, Alabama on an automated system that will project the discontinuance of processes and materials based upon regulatory trends. The EPA usually phases out the allowed use of hazardous materials over a period of time rather than cause sudden shockwaves through various industrial manufacturing sectors. Therefore, future dates of mandatory compliance are specified along with the new regulations. Rockwell's automated system isolates the trend at a material and process level. This information is then tied to specific LRU's for further analysis regarding the impact these regulations will have for future procurement. Another effort is underway at the Chief of Naval Operations Office (See Site Visit Report, Section 2.1.13 regarding a detailed discussion of how this effort results may be applied to an obsolescence predictive tool).

1.3.8.5 Company Health Influences

Due to recent cutbacks in military funding, especially in the areas of design and production, many smaller manufacturers have gone out of business. The loss of these businesses has at times resulted in the loss of valuable skills, proprietary processes, and components. Other manufacturers have shifted away from military production or have been purchased by larger manufacturers. In either

case, the continued production and availability of many components are in question, especially those that are difficult to move to another active manufacturer.

1.3.8.6 Monitoring Company Health

In addition to market and regulatory influences, the economic health of the manufacturing organization should also be monitored. Monitoring is most effective when the division or facility directly responsible for producing the component is the focus of the periodic analysis. The following is a list of ways to monitor company health:

Direct Periodic Contacts - Direct contact with suppliers can feed valuable predictive information back to the contracting office. During these contacts it is important to explore the manufacturer's ability and willingness to produce more components and to do an analysis of market and company trends. If possible, the information should be gathered through on site, face-to-face interviews. Also a contract stating the manufacturer will give prior written notice of the discontinuance of a component should be obtained whenever possible. The Industrial Analysis Support Office (IASO) is an example of this type of monitoring (See Site Visit Report, Section 2.1.15).

Industry Publications - Industry publications can alert one to changing industry trends that will impact the availability of a component and the processes that go into creating it. Trade publications also carry stories about manufacturers' successes and failures. Automated systems are now available that filter though incoming news stories for key words and company names. This type of monitoring can be centralized to reduce the cost to multiple programs.

Financial Reports - Publicly held companies are required to submit quarterly financial data. This information as well as stock price and financial market ratings from companies such as Standard and Poors can point to longer term financial problems with a manufacturer. This information is more accurate for analysis when the company in question is small to moderate in size and there is clearly a relationship between the company's overall health and its health at a particular production facility. An example of a commercially available financial data source would be Dun & Bradstreet who has developed a financial "stress code" for over 150,000 companies. This stress code predicts up to 18 months in advance, the possibility of a company facing increase financial problems (See Site Visit Report, Section 2.1.12).

Although direct contacts are invaluable and likely to be a good source of information, other ways to monitor a

company's health should not be overlooked since they may provide a more objective view of the manufacturer's health.

1.3.8.7 Product Line Influences

When a manufacturer of components that are sold on a regular basis, i.e., NDI and COTS, changes their product offerings, they usually publish notifications as well as catalog sheets and price books. The manufacturer may discontinue a part or upgrade a part with a newer version. In either case, these changes usually have a tremendous impact upon the weapon systems that utilize these components.

1.3.8.8 Monitoring Product Line Trends

For components that are made on a regular basis by a manufacturer, such as NDI and COTS, it is possible to track the availability of those components through monitoring regularly published catalogs and price books. For example, by comparing the latest price book against a previous published price book, TACTech is able to pick up on discontinuances of components and life-of-type-buy notifications. This simple method of monitoring requires minimal skills in those that check for the changes. This results in low operating costs since it is only the differences that are brought to the attention of more skilled staff. Once a change is detected, it should be verified by reviewing ancillary manufacturer publications or direct contact with the manufacturer. Once the change is verified, a database of available parts can be updated. The updating of the database can trigger notifications to anyone that utilizes the parts.

Product line monitoring is a very simple but accurate means by which early warnings can be sent directly to the users of a particular component. The costs involved are directly related to the number of manufacturers that are monitored in combination with the size of their product lines. Prediction capability can be improved by utilizing various industrial trends and applying those trends to categories of components. Note that this process should be proactive, waiting for the literature is usually not good enough, TACTech has found that they usually have to ask for it periodically.

1.3.8.9 Theoretical Sample Process to Classify a Component

The following is an example of the process one might go through in predicting the life-cycle of a component.

Step 1: Divide an assembly into its smallest parts.

Don't overlook items such as coatings, lubricants, and sealants.

Step 2: Analyze the component's materials. What about the materials contained in and upon the component may make it difficult to procure in the future? A database of processes, materials, and environmental regulations can be invaluable in this part of the evaluation.

Step 3: Analyze the component's manufacturing process by which it is manufactured. What processes are used to create this component? Look at the process that created the component as well as the processes the component went through to its completion such as finishing, painting, and anodization. Review the sub-processes as well. For example, before a sealant is applied to a surface, what chemicals are used to prepare the surface? What materials are used to apply the chemicals? A unique list of chemicals, materials, and processes should be created. Each item on the list is then checked against environmental regulations and industry trends.

Step 4: Review Mean Time Before Failure (MTBF) and actual repair histories to calculate the number of spare parts needed over the remaining life of the program. Several good analysis tools already exist to do these types of calculations for various components.

Step 5: Locate an accurate number of spare parts currently in inventory.

Step 6: Review its manufacturing status. Is the manufacturer still willing to make this component? How long are they willing to continue to make it? Are they willing to give advanced warning when they plan to no longer have the ability to produce the component? How difficult would it be to have the component made by another manufacturer? Can the component be monitored by reviewing company literature such as price books or catalogs?

Step 7: Calculate an obsolescence vulnerability code for the component. Based on the above analysis, apply a vulnerability code to the component. For prediction purposes, the code should tie in a time frame of availability. The code should also include the ease or difficulty in replacing the component.

Step 8: Reassemble the assembly and assign it the highest vulnerability code of all of the components that it contains.

Step 9: Continue to monitor changes in regulations and market trends that apply to the component. Periodically

review the health of the manufacturers that are not easily replaced.

Step 10: If secondary sourcing for the component is possible, monitor these second tier manufacturers as well.

1.3.9 Prevention

Given the detailed information obtained through a screening and monitoring process as listed above, areas of vulnerability should make themselves evident. Future designs and redesigns should avoid, if at all possible, utilizing the materials and processes that have the highest threat of causing a obsolescence problem. Ways to lessen obsolescence threats may be as simple as not choosing proprietary items, or as costly as taking a process 'in-house.' Using an item in multiple military programs may be another way to assist in keeping a production facility stable. Another way may be to look for processes and materials with fewer environmental regulations.

1.3.10 Why isn't Life-Time-Buy always the answer?

The answer to all obsolescence problems would seem to be very simple: just buy a lifetime supply of whatever component that a manufacturer is about to discontinue. There are several reasons why this answer is not always the best way to resolve an impending obsolescence problem.

Making a lifetime purchase of the component that is soon to be obsolete assumes that it is possible to accurately calculate the need for that component over the remaining life of the program. This is rarely the case as pointed out by Mr. Clark (See Site Visit Report, Section 2.1.8) and Mr. Peters (See Site Visit Report, Section 2.1.10). Most of the time the data required to make a lifetime purchase is either inaccurate or simply unavailable because tracking of the component within the support of a weapon system is minimal at best. The DLA and various other agencies do track replacement parts the Navy has and where they are located. Who uses the part is poorly tracked due to factors such as contractors that don't release the information to the Navy as well as repair depots that utilize other channels to obtain replacement parts than the DLA.

Add into this problem the changing demands made upon the military (such as force reductions, extended operational life spans for equipment, and budgetary cuts resulting in constantly shifting staffs), and the ability to calculate an accurate lifetime purchase quantity becomes a daunting challenge.

Another reason for not choosing a lifetime purchase of a component was expressed by David Devine (See Site Visit Report, Section 2.1.11). If a part has a high failure rate it may be better to redesign the part in order to increase mission readiness rather than purchase a large quantity of a part that has a low Mean-Time-Before-Failure (MTBF) rate.

Mr. McLeish of HONE, (See Site Visit Report page 2.1.11), pointed out that a 'Big Picture' view of a pending obsolescence problem could suggest a much different solution. With the downsizing of the U.S. Navy, many aircraft and ships are being mothballed. The equipment and support equipment on these platforms provide a source of replacement parts for the equipment that is still in service. Thus rather than procuring replacement parts, parts could be reclaimed from mothballed equipment. Also the big picture perspective could indicate that an expensive procurement is unnecessary since the equipment in question may be replaced in the near future.

1.3.11 Prediction vs. Early Warning

Prediction of component obsolescence is the projection of a future time period upon which the component is no longer available. This time period may be months or years and is based upon a variety of trends. Early Warning is also a projection of unavailability, but is based upon direct information from the manufacturer.

Early warning of a discontinuance by a manufacturer is by definition more accurate than prediction since the warning is based upon direct information from the manufacturer.

The accuracy of warnings is, of course, based upon the manufacturer diligently notifying the consumers of its anticipated unavailable components and the consumers being able to track where they have used the components. Early warnings usually have a time period of six months to two years within which the consumer can order more of the component that is about to be discontinued. The time delay between receiving the notification and ordering of components within the military contractors and DoD agencies is usually measured in months. Shortening this delay and receiving the notice as soon as possible is crucial to utilizing a "life-of-type buy" as the solution to an availability problem. Companies such as National Semiconductor, Corporation (See Site Visit Report, Section 2.1.19) have manual and automated systems to provide component obsolescence warnings to customers and the Government and Industry Data Exchange Program (GIDEP) in order to communicate pending obsolescence. Services such as GIDEP and TACTech are funnel points that concentrate discontinuance notices from manufacturers into a central

database structure.

Prediction, due to its near-term inaccuracies relative to an early warning system, is better used as a general guideline for discontinuance because it will never be able to consistently pinpoint the exact time a component or type of component will no longer be available.

Early warning systems are more applicable for short-term support, up to approximately two years. Prediction tools are better suited for long-term planning of two to ten years. It should be noted that the accuracy of any prediction system decreases with the length of time forecasted.

1.3.12 Making the Connection

Having various sources of incoming data is of little value without the ability to connect that data to military platforms. To be told for example that CFC's will be banned from use within five years means little to the military program manager and his/her staff unless they can pinpoint where the CFC's are used on the platform and which of the components manufacturing processes require the use of CFC's.

1.3.12.1 What is the Connection, and Why It is Needed?

By connecting industry trends, environmental regulations, manufacturer discontinuance, and financial statistics to the components affected, early warnings and long-term predictions can be traced to the component level of every military platform (Refer to Figure 2 for the remaining discussion on this topic).

Making these connections, although necessary for an effective obsolescence prediction tool, is very time consuming and costly. Most parts lists for military equipment are inaccurate and have vast amounts of missing information. It is the exception, not the rule, that an accurate 'as built parts list' can be quickly and easily obtained for any given piece of equipment. JCALS, CITIS and other initiatives are attempting to remedy this situation.

Many times the data provided by contractors is purposely vague. In fact, even 'Level 3' drawings often lack detailed information such as processes, materials, vendor part numbers, etc. The information needed to make the connection to incoming trends and data is, however, obtainable from multiple sources. These sources include 'Technical Referrals', DLA records, repair depot records, cooperative contractors, and some drawings. The consolidation of this data into a comprehensive database is a manually intensive

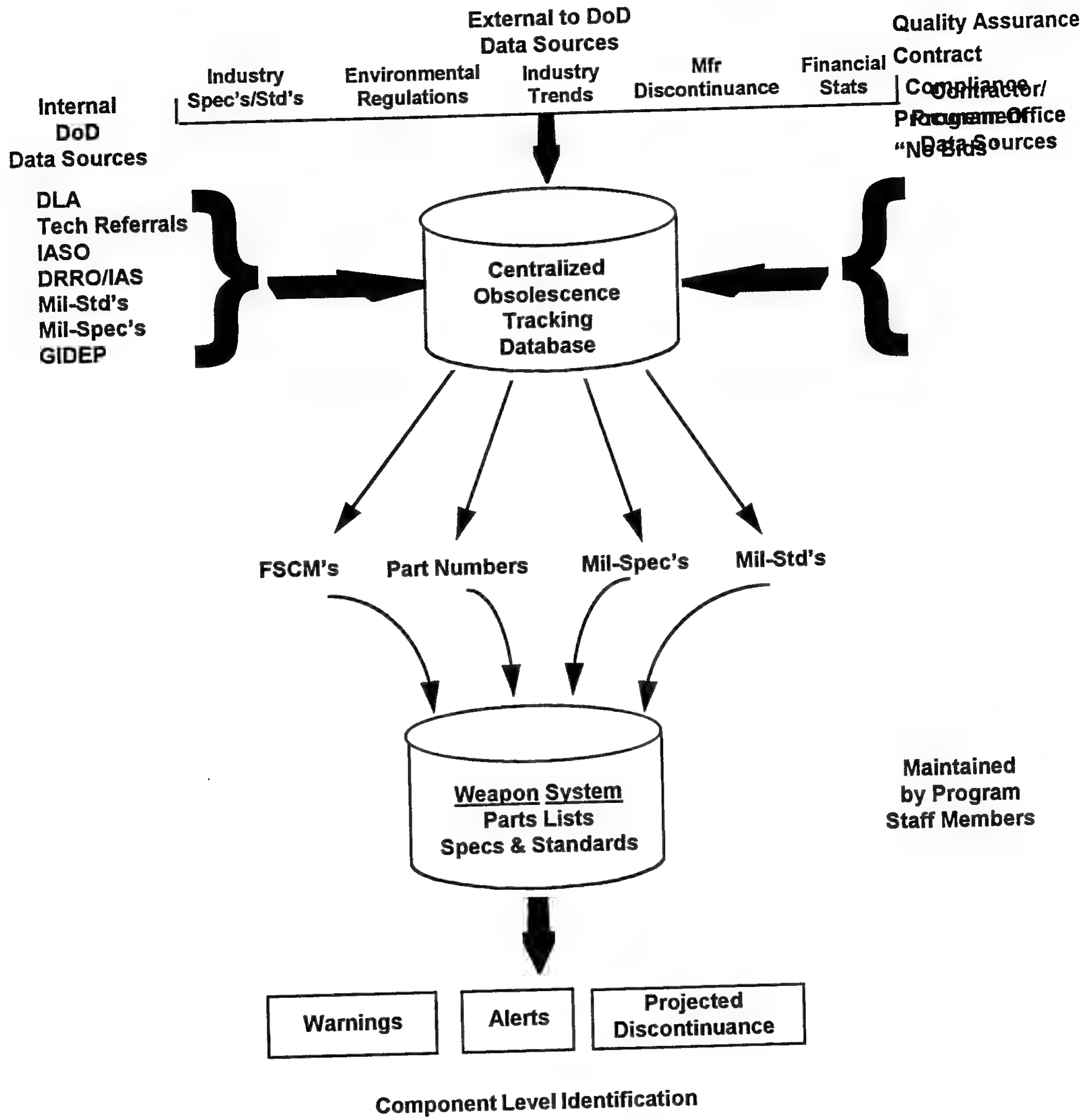


Figure 2
Making the Connection

and time consuming task. The more accurate the parts list for a piece of equipment, the less likely that some key component will miss a critical discontinuance or pending obsolescence alert. Thus, a trade off exists between the costs involved in obtaining an accurate parts list and the cost of missing a critical alert notice (See Figure 3).

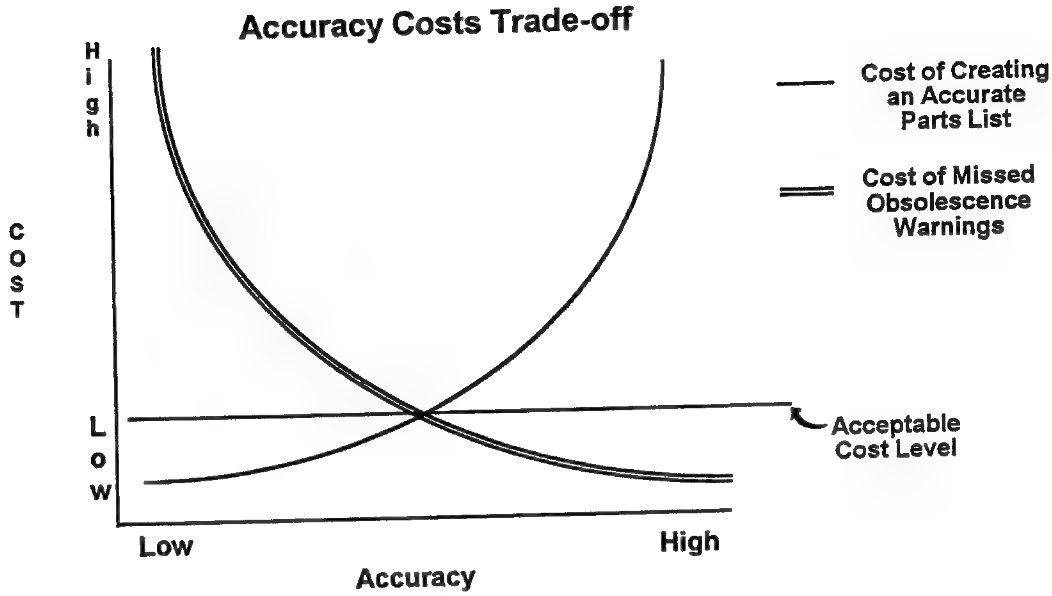


Figure 3
The Trade-off Between Accuracy and Costs

To date, most 'as built' parts lists contain a part numbers, a manufacturer's FSCM code, and the quantity used in the next higher assembly. For tying financial data, and company discontinuance notifications to a part, this information, if it is accurate, is all that is necessary. TACTech's early warning system that provides alert notifications for electronic components operates under this principle.

In order to tie industry trends and regulatory changes to a component, the processes and materials used to make the component must be known and added to the parts list. One method by which this can be accomplished in a cost effective manner is to list all of the Military Standards and Specifications for each component (See Figure 4).

A second database that maintains a cross reference between Military Standards and Specifications and the materials and

processes called for within those regulations would be part of the predictive obsolescence tool. As changes take place to this second database such as new EPA regulations, the

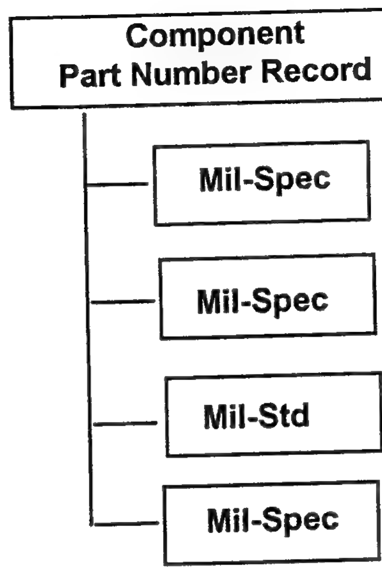


Figure 4
Part Number Record with Attached Specs & Standards

effect of those changes would be automatically pinpointed within the weapon platform's parts lists. It can then give the program manager and his/her staff a report of exactly where the impending changes will impact their projects (See Figure 5).

The costs involved in creating the two databases listed above are staggering. There are over 14 different government agencies regulating materials and processes, over 2,200 regulated chemicals and materials, over 600,000 government contractors, and over 3,000 industry trade organizations. Maintaining a database of this size is very costly let alone the costs to a program office to clean-up their parts lists. Only through the use of modern information technology and by focusing on component categories with the highest incidence of obsolescence, with the greatest cost, or mission readiness impact can the costs of building and maintaining an obsolescence prediction tool remain affordable.

Each program office would be responsible for creating and

maintaining their own parts list database. To keep costs reasonable, the 'Military Standards to Process & Materials Cross Reference' database would be built and maintained in a centrally located computer system. This database would be accessible to all participating program offices and their contractors. The Cross Reference database would be a cooperative effort incorporating information from commercially available sources, DoD agencies, and analysis provided by contracted research firms.

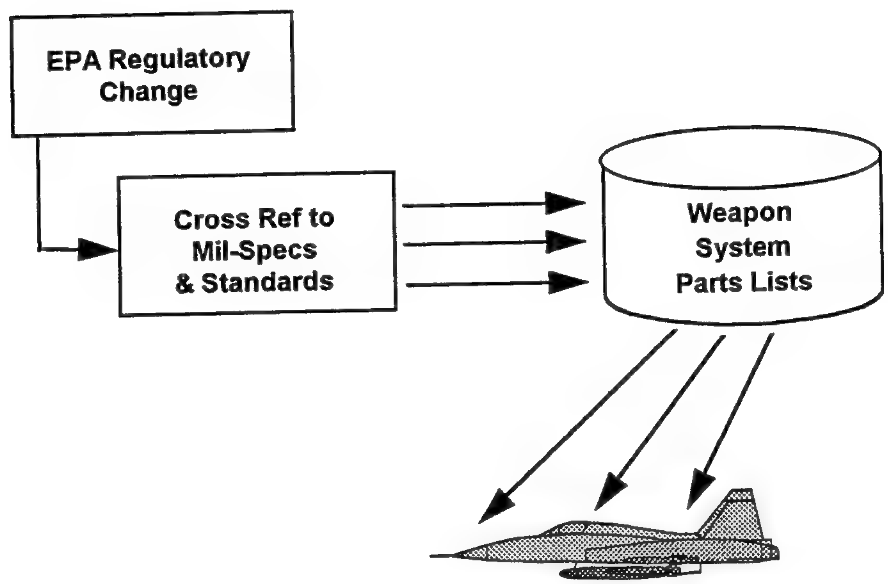


Figure 5
Connecting Environmental Regulatory Changes to the Weapon System

This approach that connects part numbers to the materials and processes by which they are created is efficient but does have some flaws. Specifically, many materials used to make a component are not specified in Military Specifications and Standards; Either the Specifications and Standards don't cover the exact materials used or the item was procured without these detailed specifications. In either case, the information necessary to make the connection is missing. An area where the data is most likely missing is in the chemicals and materials used to manufacture the component. These ancillary materials and by products are themselves subject to regulatory pressures resulting in the potential for a manufacturing process being discontinued. Rockwell International, Downey California,

and NASA have focused on this very problem regarding the components of the Shuttle Orbiter (See Site Visit Report, Section 2.1.25). Through the cooperation of contractors and Rockwell engineers examining the drawings, components, and manufacturing processes, Rockwell has compiled a detailed parts list database that includes this information (See Figure 6 for the expanded record structure). The process of building this type of database is very expensive but has been easily justified by the increased visibility of approaching obsolescence problems.

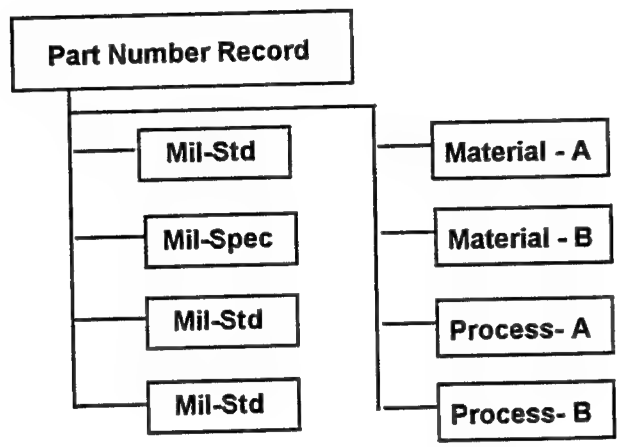


Figure 6
Expanded Part Number Record

1.3.12.2 What trends are making connections more difficult?

The move towards NDI (Non-Developmental Items) and COTS (Commercial Off The Shelf) and away from Military Standards and Specifications will continue to erode the visibility of the kinds of materials and processes used to create components. The increasing pace of technological change and the incorporation of newer technologies into existing weapons platforms will also increase the difficulty of tracking and monitoring obsolescence. Additionally, with a declining DoD budget, military specific materials and processes will become obsolete at an ever increasing pace.

1.3.12.3 Making the Connection: A Real World Example

In order to assess the difficulty of connecting the materials and processes to a component, an actual component was selected from the Nato Sea Sparrow as a test case. The NATO Sea Sparrow is a ship-based surface to air missile used for defense. A Bearing assembly was chosen since it incorporates multiple sub-components as well as lubricants and coatings. Copies of the drawings for the bearing are located in Appendix A.

The first step was to break the assembly into its component parts (See Figure 7). A list of the Military Standards was then extracted from the drawings.

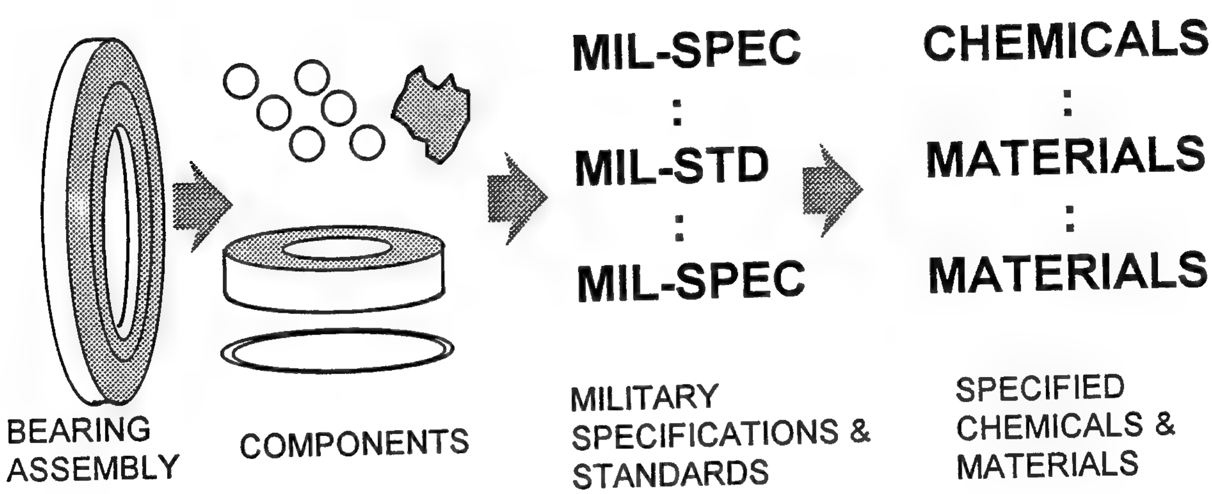


Figure 7

Making the Connection: A Real-World Example

Military Document	Area of Focus
NAVORD 2890370	Dimensions/Tolerances
NAVORD XWS-9772	Shipboard Environment
MIL-E-17555	Delivery Preparation
MIL-Q-9858	Quality Assurance
MIL-P-16232 Type M,1	Finish, Coating
RC 30-34	Bearing Hardness
MIL-G-23827	Lubrication
MIL-STD-454 Req. 9	Workmanship

Listing 1

Some of the specified documents were either lost or unavailable for this research project, these include: NAVORD XWS-9772, and RC 30-34. The chemicals and materials called for, if any, within these documents have been excluded from further research due to a lack of time.

A list of chemicals and materials was developed from the remaining specifications and standards (See Listing 2). The chemicals listed are used in the processing, preserving and testing of the bearing other than the Manganese Phosphate.

Military Doc.	Chemicals/Materials
MIL-G-23827	Performance Requirements Only
MIL-P-16232	Manganese Phosphate
	Alkaline
	Chromic Acid
	Chromic-Phosphoric Acid
	Oil (Preservation)
	1,1,1-trichloroethane
	Sodium Hydroxide
	Sodium Cyanide
	Alcohol
	Ascarite/Soda-lime
	Sodium Hydroxide
	Hydrochloric Acid

Listing 2

Note that the lubricant called out by MIL-G-23827 is only specified by performance requirements. The particular chemical used would have to be obtained from the manufacturer supplied MSDS's (Material Safety Data Sheets). These were checked against the California EPA "List of Lists" for possible regulatory statutes (See Listing 3).

The right-hand column indicates the number of regulating documents that list the chemical.

Chemical	# of Regulatory Documents
Manganese Phosphate	0
Alkaline	0
Chromic Acid	1
Chromic-Phosphoric Acid	?
Oil (Preservation)	?
1,1,1-trichloroethane	10
Sodium Hydroxide	4
Sodium Cyanide	3
Alcohol	0
Ascarite/Soda-lime	?
Sodium Hydroxide	4
Hydrochloric Acid	10

Listing 3

At this point, further research needs to be done regarding the regulatory trends and their effects upon the required coating and lubricants. This process is quite time consuming but once accomplished, the information can be utilized for every military standard and specification as well as other components that call out those specifications. Thus, once the work has been completed, it is applicable to many unrelated components. The key is to have this information in a central repository so that the work is not done over and over again.

1.3.13 Automation Can Help

Computer Automation is the key to making obsolescence prediction analysis economically feasible.

1.3.13.1 Information Technology Concepts in Design

Three concepts play an important role in the design of automated systems. These are:

Data Concentration -- By placing vast amounts of information from various sources (such as EPA regulations, market and technology trend analysis, manufacturer profiles, and component breakdown and descriptions) into a single computer system, the amount of time wasted by needless re-researching is eliminated. Once a process is defined, there is no reason to define it again.

Data Access -- Once the data is concentrated providing easy access to it is the key to turning the data into valuable information. The system must have automated analysis and monitoring tools in order to reduce the time necessary to define and track a component's obsolescence vulnerability.

Process Integration -- By designing an automated system so that it integrates into the daily work patterns of its various users, the system can become an integral part of the obsolescence monitoring and problem solving process. Thus, the system is seen as essential to complete the tasks at hand while at the same time providing an environment that makes the sharing of problems and solutions possible.

1.3.13.2 Key Data Elements of the System

Configuration Management -- Tracks individual components down to the material and processes by which they are manufactured as well as standard parts list indenturing.

Regulations & Trends -- Contains a cross reference to processes/materials and the Federal/State regulations that pertain to them. A projected discontinuance based upon the regulatory trends is incorporated so that a regulatory life cycle factor can be calculated for any given component.

Market Trends -- Tracks and stores trend information for the various commodities and technologies used to manufacture the components.

Manufacturer Profiles -- Stores detailed information about each manufacturer that makes at least one component. Information such as financial health, projected production capabilities, military vs. commercial income would be entered into this system. Automated tracking of news reports and financial data would also be placed into this system.

Manufacturer Component Availability -- Contains an up-to-date list of components that a manufacturer is currently producing that are sold on the open market, not custom designed parts.

Procurement History/Failure Tracking -- Contains detailed procurement history as well as analysis tools for calculating end-of-life buy quantities based upon recorded failure analysis.

Each of the above areas would be integrated into one seamless environment from which projected obsolescence vulnerability would be calculated at the component as well as system level. Components with a high vulnerability would

be easily and quickly isolated for further analysis and preventative measures.

1.3.13.3 What kind of tools are needed?

As regulations changed and as manufacturing capabilities changed, alerts would be generated at the component level for those components whose vulnerability had increased.

The following tools or functions are needed to make full use of the data elements listed above:

Tracking -- The ability to view a history of components' vulnerability issues.

Automated Monitoring -- The system automatically searches through weapon platform parts lists looking for components that match one that has had a recent change to its obsolescence vulnerability. Once a part is located within a parts list, a notification is automatically sent to the cognizant activity.

Integrated -- The system provides rapid access to information from various data resources. For example, if the user receives an obsolescence notification for a part, he or she would be able with a push of a button to locate information about the manufacturer, potential alternate suppliers, DLA stock levels, other programs that utilize the component, maintenance history, DMSMS case history, etc.

Pooling/Sharing -- The system would have built into it the ability to gather and share data in various formats from other computer systems such as the new GIDEP DMSMS case logging system. This would also provide a means by which current contractor, depot, and program office information can be automatically loaded and unloaded from the system.

Analyze -- The system would incorporate an artificial intelligence rule based system that would assist users in calculating life-of-type buy quantities based on available information and probabilities. The system would also create production readiness reviews that would pinpoint procurement problems and project near-term obsolescence vulnerabilities.

Research/Predesign -- The system would incorporate an easy to use research facility that would allow engineers to review obsolescence factors when choosing a new component, material, or process for a design. This function would allow for a 'check before you build' capability.

Case Management -- A system that allows engineers to log DMSMS problem components and the solutions used to solve the

problems. This information will then be accessible for future reference.

1.4 Recommendations

1.4.1 Focusing to Reduce Costs

The cost associated with obtaining, categorizing, and analyzing external and internal data is so high that focusing on the component categories with the largest obsolescence problems is essential for keeping the costs feasible.

Those categories, according to the research completed to date, would be electronic components, electro-mechanical devices such as relays, connectors and switches. Other categories that should be focused on include highly regulated materials that are used almost exclusively by the Department of Defense. Locating which materials fall into this category is in itself a project. The framework laid out in Section 1.4.2 is generic enough to handle any type of component used by the Department of Defense.

By focusing on the component categories with the greatest obsolescence problems, the amount of external data to be gathered can be significantly reduced. For example, the commercial manufacturing firms that would be monitored could be reduced to only those companies that manufacture military approved electronic or electro-mechanical devices, approximately 600.

Since most of these devices are sold in an open market condition, it would be possible to utilize Product Line monitoring as discussed in Section 1.3.8.8. Although the processes used to make many electronic components incorporate hazardous and regulated materials, the demand for the processes is such that viable production will be maintained even under regulatory pressures. Alternate processes will be located to keep pace with regulatory changes.

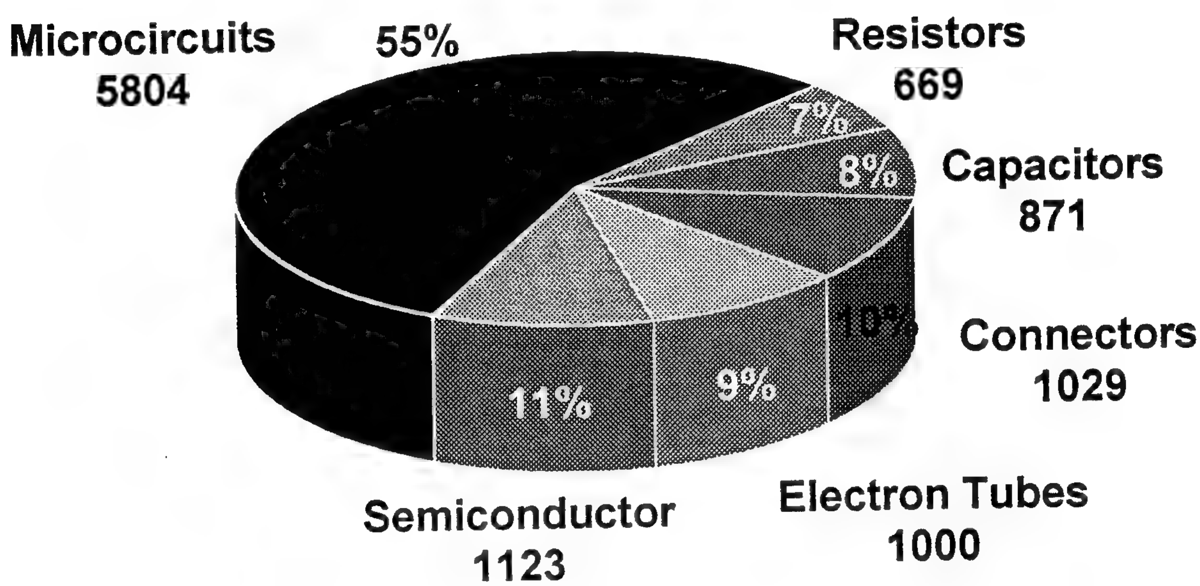
The cost of constructing a product line monitoring database is directly related to the number of components and manufacturers being monitored. Building the product line library is only the first step, the library must then be updated to keep it accurate with the changing product offerings from the manufacturers. The original entry and categorization of the components requires approximately twice the workload of maintaining the information once it has already been entered.

According to DESC in 1992, 66% of electronic parts obsolescence was contained in integrated circuits, diodes,

and transistors. Electron tubes and connectors comprised an additional 18% for a total of 84% (See Figure 8). This data would support the relationship of obsolescence vulnerability to the complexity of the component. Depending upon available funding, the construction of the product line monitoring database should first focus on the electronic component categories, thus producing the greatest benefits early in the project.

ANNUAL DISCONTINUANCE BREAKOUT BY COMMODITY

DESC 1992 DMS BREAKOUT



Source: DESC

TOTAL DISCONTINUANCES: 10,496

Figure 8
DESC Pie Chart

An alternative to constructing the entire product line library is to purchase pieces of the library that commercial firms have already developed. The comprehensiveness of these component libraries and the timeliness of their updates would then determine whether additional funding is

required to fill in any gaps within purchased data. Updates to the product line library could also be contracted to commercial firms or accomplished within the DoD.

As the Hazardous Materials database at the offices of the Chief of Naval Operations is completed, a second effort to expand the obsolescence predictive tool to incorporate environmental regulatory information should be reviewed for feasibility and need.

1.4.2 Overview of Recommended System Design

This section describes the design of an automated obsolescence prediction tool that meets the criteria of the recommendations in Section 1.4.1.

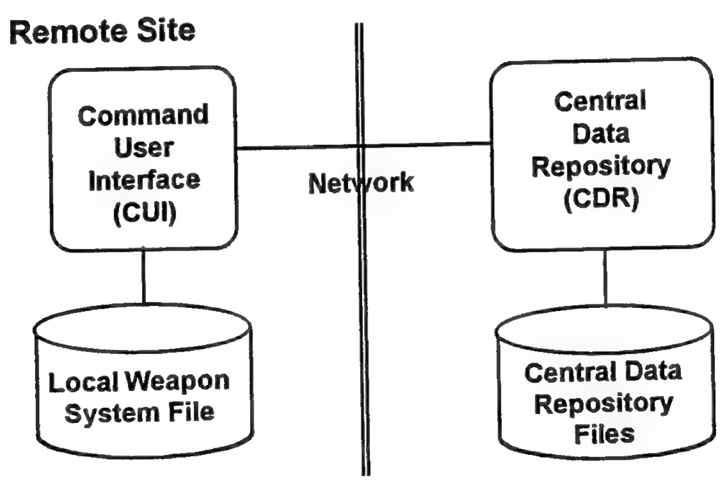


Figure 9
Obsolescence Predictive Tool (OPT)

1.4.2.1 Systems design concepts

There are two basic components to the Obsolescence Predictive Tool (OPT) system: the Command User Interface (CUI) and the Centralized Data Repository (CDR) (See Figure 9). The OPT will incorporate industry standards such as

Graphic User Interfaces and "Open Systems" design concepts. OPT software and hardware will be purchased off-the-shelf with all programming done in a high level, commercially available 4th generation language.

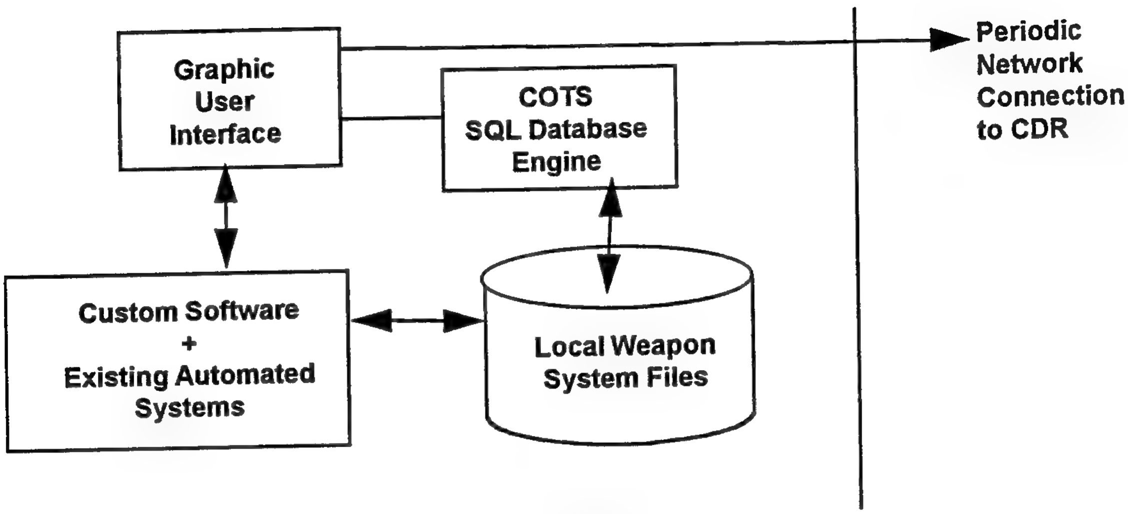


Figure 10
Command User Interface (CUI)

The OPT system is not the final answer to the needs of every Navy department, but it does incorporate all of the commonly needed functions for DMSMS management as listed in Section 1.4.2.1. From the on-site visits made to various Navy installations it was quite apparent that each command has its own special needs and methods of operations. From the lowest data element level to the user interface itself, the OPT system is designed so that it can be easily integrated into existing automated efforts. For example, the data within the CUI will be maintained in a COTS (Commercial-Off-The-Shelf) SQL based relational database (See Figure 10). The tables within this database will be clearly defined such that programmers at the CUI's site will be able to directly access and enter data into these tables, bypassing the CUI software. In this manner the data of the OPT system can be easily integrated directly into existing automated systems at the CUI's site.

The OPT system is designed to be expandable. As new sources of information become available and as new areas of high obsolescence vulnerability are identified, the OPT system will incorporate the changes without modifications to the existing data structures and software. The data structures and user interfaces will see this new information as new categories of data.

The Centralized Data Repository (CDR)

The CDR provides a place in which information can be concentrated and shared amongst the various CUI's. A central computer within the Navy would contain the CDR. The CDR will have an automated communications module to relay information to and from the command systems. Information would be exchanged between the various CUI's and the CDR on a periodic basis. The CDR would contain information gathered from outside of the DoD as well as information generated from within the DoD. Whether the data resides on the CDR or the CDR is merely a gateway to other computers is immaterial to the users because the CDR would provide a consistent, automated storehouse/pipeline of continually changing relevant information (See Figure 11).

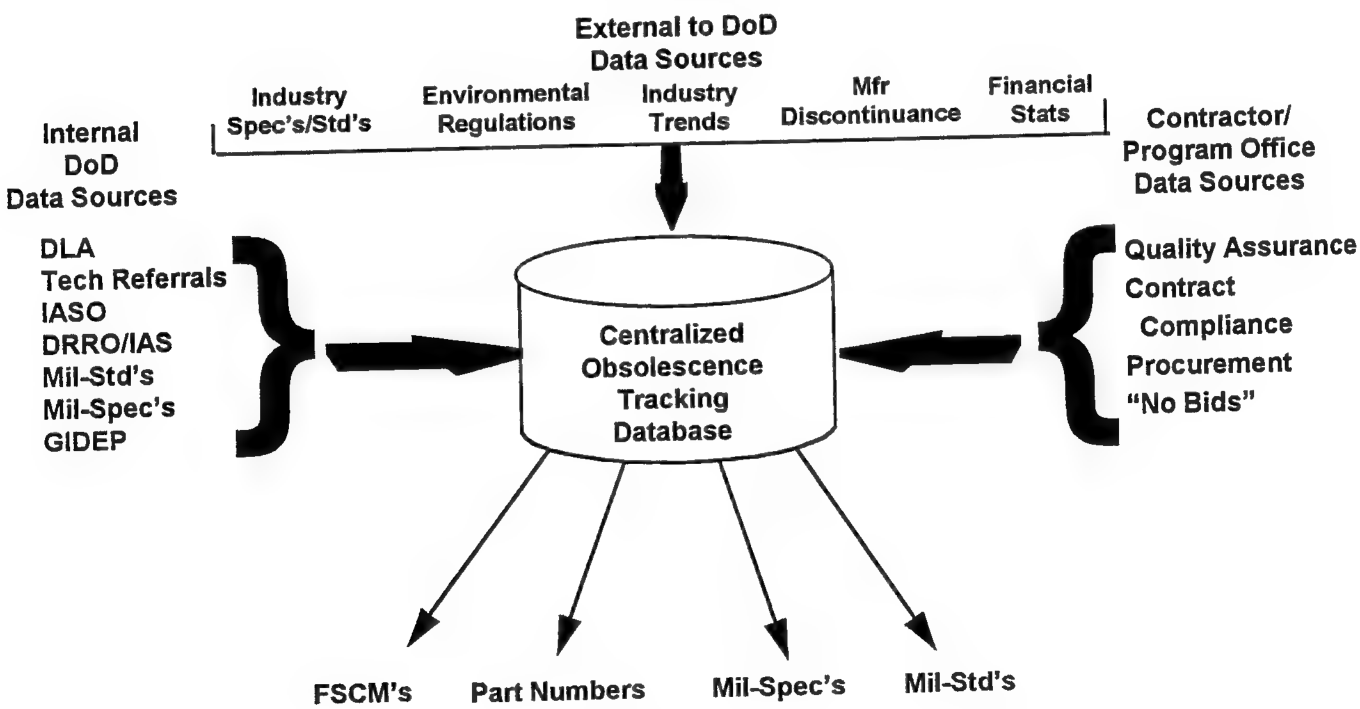


Figure 11
Data Sources for the Central Data Repository (CDR)

The CDR is also a repository for information from the command systems. DMSMS case problems and solutions could be automatically placed within the CDR for use by other commands and CUI's. The CUI would contain a module that automatically searched the CDR when a user enters a DMSMS case. The CUI will then display the results of this search to the user for further evaluation. The case the user enters and subsequent updates to that case would also be transferred to the CDR automatically. The CDR would interface periodically with the DMSMS Case system that GIDEP is developing. The CDR will provide visibility to other military branch's DMSMS cases as well as the cases from Navy commands.

The Command User Interface (CUI)

The Command User Interface (CUI) is the module that users will directly work with. A variety of hardware platforms will house the CUI. The choice of hardware will depend upon the needs of each CUI site. For sites managing a single, small weapon system, a series of standard personal computers networked together would suffice. However, a command managing multiple, large weapon platforms may need a series of workstations and a main-frame computer operating as a file server could be utilized. Thus the size and cost of the CUI installation can be tailored to the needs of the command or department that will utilize it.

The CUI would utilize a Graphic User Interface. Pull down menus, graphic representations of the data, and other graphic elements would make the CUI easy to use and powerful simultaneously. Personal computer platforms would use Microsoft Windows as the interface. For workstations, the user interface would be Motif or OpenWindows.

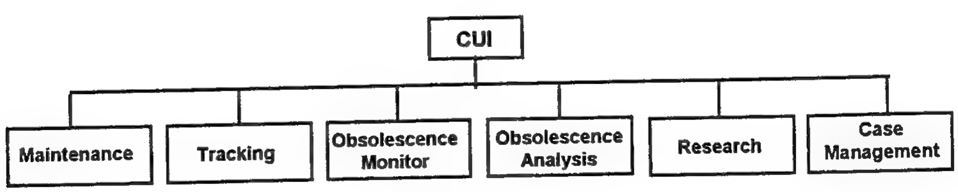


Figure 12
Command User Interface (CUI)
Functional Diagram

The CUI would provide the following functional capabilities (See Figure 12):

Maintenance -- would allow the users to rapidly build and modify weapons system parts configuration files. Automated tools incorporating rule based Artificial Intelligence would assist the users in categorizing and updating parts information. Reference material regarding processes, military standards and specifications would be easily available on the screen or through an automated connection to the CDR (See Figure 13).

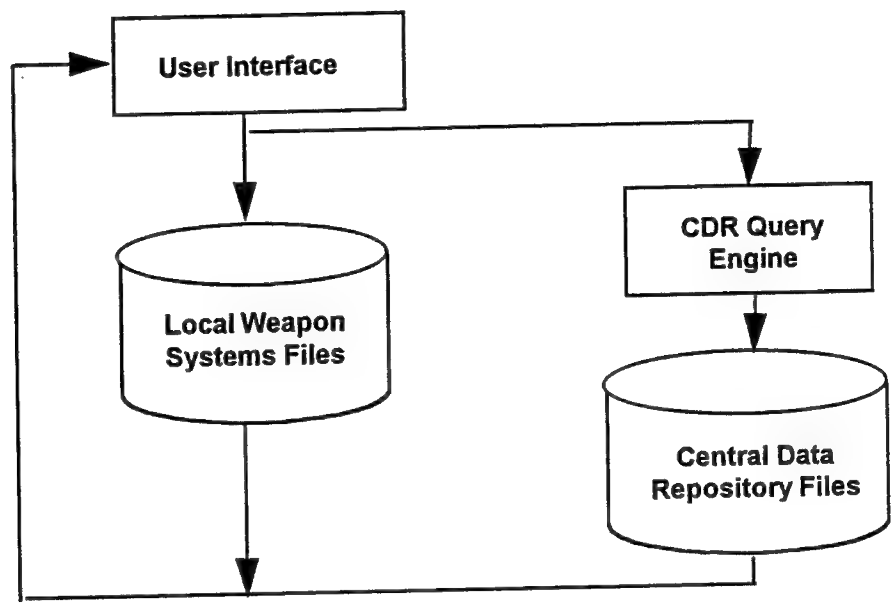


Figure 13
Maintenance/Tracking

Tracking -- provides users with the ability to quickly locate where a part is used and historical information regarding the obsolescence vulnerability of a part or an assembly. For example, the Tracking Module could easily answer a question such as such as "where is the Texas Instruments 9989 microprocessor used?" (See Figure 13.)

Obsolescence Monitor -- constantly monitors changes to the vulnerability of parts within the CUI weapon systems files. Periodically the Obsolescence Monitor would collect updates from the CDR and internal data sources. It would then

process these updates, filtering out parts that exceed predefined thresholds set by the users. The system would then send alert notices to the cognizant users for parts that exceeded a given threshold (See Figure 14).

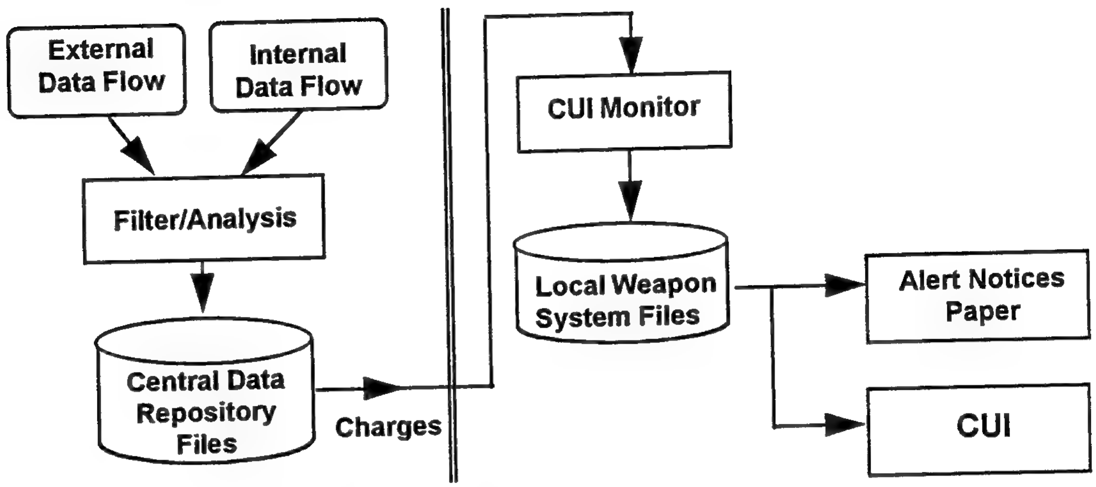


Figure 14
Command User Interface
Obsolescence Monitor

Obsolescence Analysis -- provides detailed statistical reports regarding a projected or existing discontinuance at any assembly level. This module gives an up-to-date analysis of the obsolescence vulnerability of an assembly (See Figure 15). The projected discontinuance would be based on industry trends, regulatory trends, and the financial health of the companies involved. These factors and others (See Section 1.3.8) would be weighted depending upon the component category. The weighting and selecting of factors is determined by a rule based artificial intelligence engine and expert advice.

Research -- provides the user with easy to use query tools for locating obsolescence related information pertaining to a component, assembly, process, or material. Regulatory, commercial & military specifications, as well as industry and government generated alerts would also be available on line. DLA, depot and other information could also be accessed through the Research module. Key word hyper-links

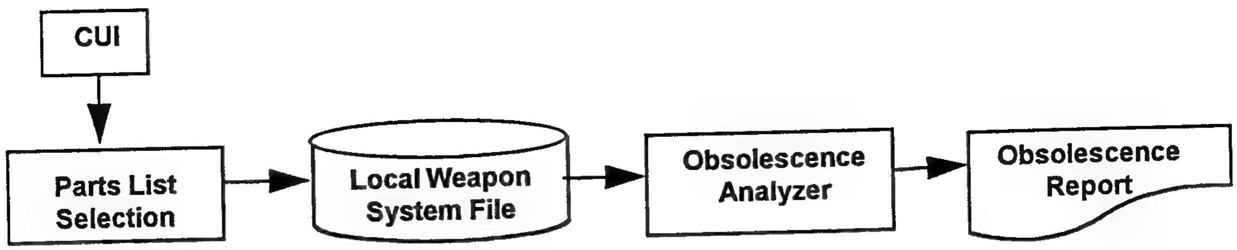


Figure 15
Command User Interface Obsolescence Analysis

and a natural language text search engine would help the user efficiently navigate through this massive amount of information (See Figure 16).

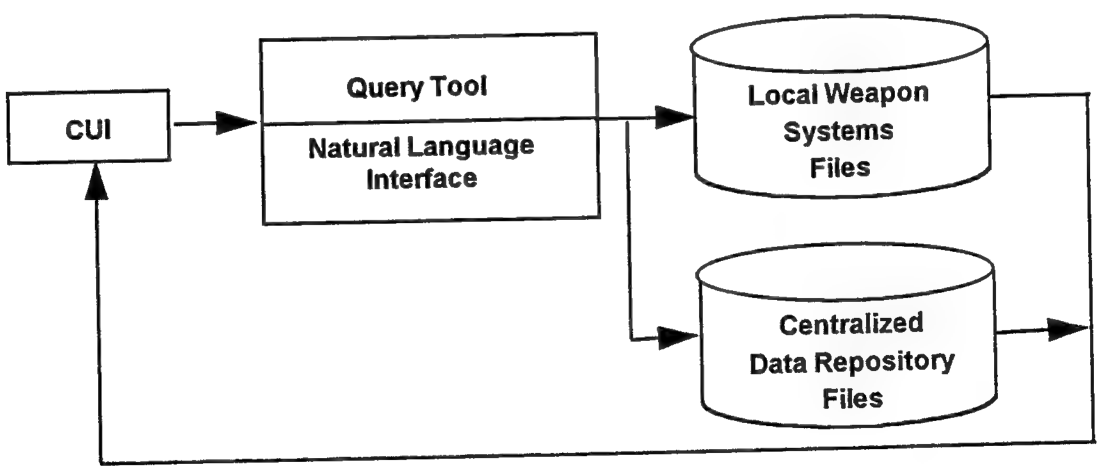


Figure 16
Command User Interface Research

Case Management -- provides a log to record DMSMS cases. Upon receiving a notice from the Obsolescence Monitor, the user can automatically open a case within the Case Management System (CMS). As work progresses towards a solution, the case is updated and then finally closed when a solution is reached (See Figure 17).

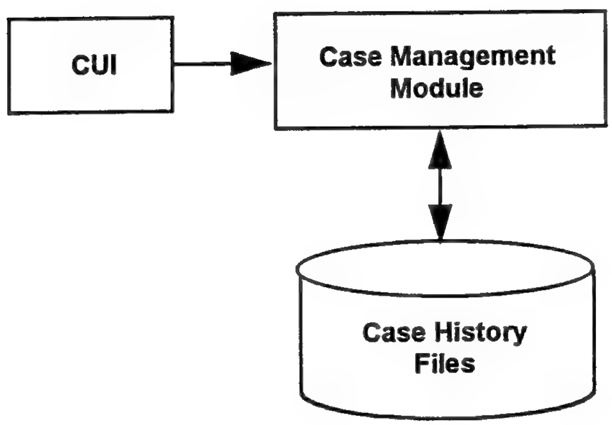


Figure 17
Case Management

The above listed modules would provide the core facilities necessary for predicting, tracking, monitoring, and solving obsolescence problems.

To support the monitoring and analysis of component obsolescence within the CUI, a periodic flow of information would be received from the CDR. Other information would come from CITIS systems meeting MIL-STD-1388-2B and local company or command computer systems. Data from the CUI would be available in CITIS standard file formats and ASCII formats. Custom developed data input and output could be easily developed by programmers at the CUI site.

CUI/CDR Data Exchange Process

This transfer and update of information between the CUI's and the CDR would take place in a three step process. First the CUI system would periodically request an updated summary of all changes that have taken place since its last update (See Figure 18 step A). The CUI system would then check the

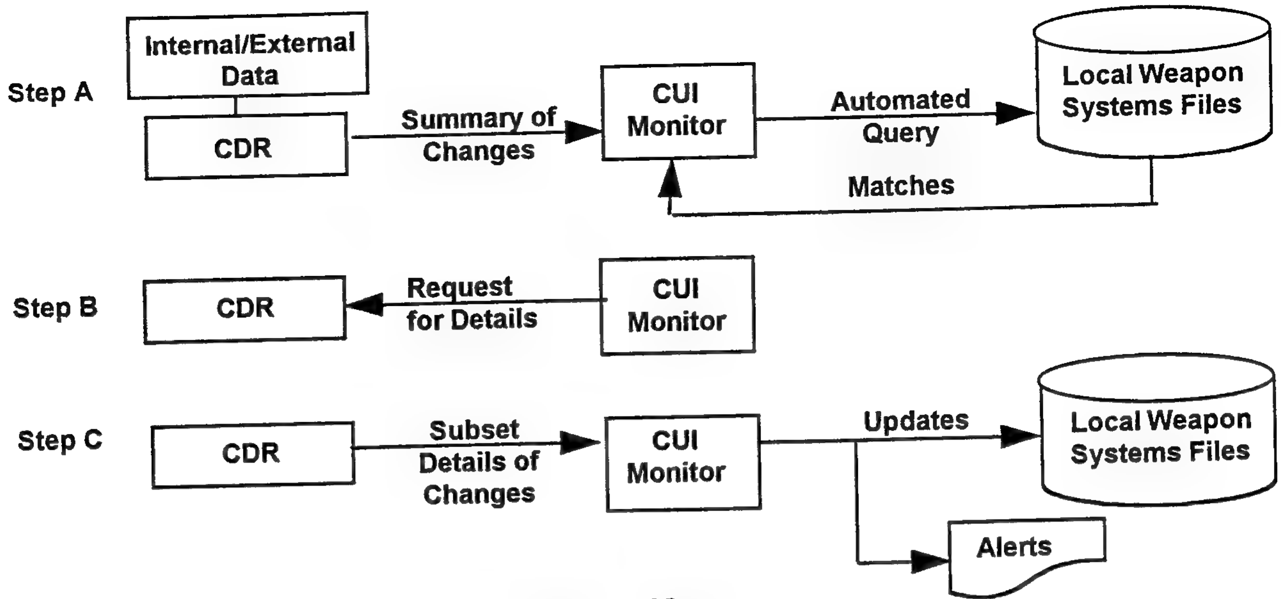


Figure 18
CUI/CDR Periodic Data Exchange

summary list to see if its database contains any matching records (See Figure 18 step B). All matches would then be sent to the CDR to request more detailed information. The CDR would then send the detailed records to the CUI system, (See Figure 18 step C). In this manner, the CUI systems would maintain an up-to-date subset copy of the information housed in the CDR. Because this subset would be much smaller than the complete set of data on the CDR, it will allow for the clients to use smaller (and thus lower cost) computer systems that will correspond to the size of the weapons system(s) being managed. Finally, the CUI's pass DMSMS case information to the CDR as part of the periodic update process.

1.4.2.2 Connectivity

The communication between the CUI's and the CDR will take place over a variety of standard networks. For large data transfer requirements, direct connections through the MILNET or Internet would be applicable by using standard TCP/IP and PPP protocols. For remote access, communication could take place over standard telephone lines and dial-up modems.

1.4.2.3 Internal DoD Data Sources

The DoD collects vast amounts of information on a daily basis. Data resources such as changing environmental regulations, discontinuance warnings received from manufacturers, changes to mil-specs and standards, DLA stocking levels, repair depot statistics, and GIDEP discontinuance notices would be fed into the CDR or made accessible to the CDR through electronic gateways. Additionally, government contracted research for areas of particular concern would also be made available through the CDR. Ultimately the CDR would become a library resource within which users could access DoD related documents in text and graphic form.

1.4.2.4 External DoD Data Sources

Data generated external to the DoD would also be placed into the CDR. For example, data resources such as Dun & Bradstreet's financial stress factor, manufacturer discontinuance notifications, industry trends and alerts would be placed into the CDR. Additionally changes detected between updates from the various sources would be fed to the CUI's as update notices. Agencies and contractors could be contracted by the Navy to provide concise analysis and projected trend information through the CDR.

1.4.2.5 Private CUI Data Sources

Each CUI is capable of expanding according to the individual site needs by adding additional categories of data. Flags and thresholds could be set for each category to allow for the generation of automated alerts and obsolescence threat level codes. Provisions could be made for information generated inside an organization to only reside on their CUI. This data would not be shared with the CDR and ultimately the other CUI's if the organization considered the data to be of a sensitive nature. Data that might fit into this category may include purchase histories, no bid notices to RFQ's, quality inspection reports, Material Safety Data Sheets, engineering change orders, etc. This information would appear on the CUI as additional categories of data.

1.4.2.6 Recommended Systems Design Wrap-up

Some of the functions described above already exist in systems found at various Navy installations. For example, NUWC, Keyport's system has an extensive DMSMS case management facility already constructed. NSWC, Port Hueneme's Health Model is already collecting data from many internal DoD sources and providing a monitoring capability.

Section 1.5 will describe a pilot project that will build upon these foundations.

1.4.3 Changes in Regulations/Contracting Practices

Through the research conducted on this project, several additional recommendations outside of but related to an obsolescence predictive tool have become apparent.

The following recommendations were addressed by Sharon Woodruff, of Rockwell International and are supported by research done for this project (See Site Visit Report, Section 2.1.13):

MSDS (Material Safety Data Sheets) that list chemicals and materials should be delivered in a standardized electronic form for parts procured by the DoD. This requirement may follow the lines of the CITIS data structures standards set forth in MIL-STD-1388-2B.

Processes involved in making parts for the DoD which utilize chemicals and materials should also have MSDS's delivered in a standard electronic form.

The above listed MSDS's should be kept in a central repository such as the HMIS system for easy retrieval and cross reference.

Manufacturers qualified to make electronic components under the QML (Qualified Manufacturer List) program should be required to provide a minimum one year life-of-type buy period. Additionally, the government or other 'after-market' manufacturers should be given first rights to purchase the process and die masks, and existing stocks of die should be made available to after market sources.

1.4.4 Changes in Information Flow from Government

The following recommendations are a result of research conducted under this effort:

The DoD should develop a centralized, electronically accessible, full text database of current Military Specifications and Standards. Updates and changes to the documents would be noted and keyword indexes would be available. Full text searches and graphic images would also be accessible.

A centralized, electronically accessible database of environmental regulations and a record of the historical changes to those regulations is also needed. Information from the EPA, OSHA, and state environmental agencies would

be fed into the repository. As changes to regulatory statutes occurred, notifications would be made available within the repository. Queries such as "What are the current regulations for Cadmium Acetate at a Federal and State level?" could be quickly answered. Dates of compliance and historical data would provide trend information and projected discontinuance of materials and processes.

1.5 Proposed Phase II Pilot Project

For Phase II of this SBIR (Small Business Innovative Research) project, a pilot project as described below would test the recommendations and findings of this research. It would also provide the basis for a Navy-wide and eventually DoD-wide Obsolescence Prediction Tool.

The pilot OPT system would utilize existing software or at least the design concepts of already developed systems within the Navy as a foundation. Systems to be included would be the Health Model from NSWC, Port Hueneme, California and the Case Management System from NUWC, Keyport Washington. It would also include data from resources such as Dun & Bradstreet, TACTech and Information Handling Service (IHS). To keep costs of the pilot project low, the construction of new data libraries would be focused on a specific weapon system's components. Cost/time estimates to build comprehensive data libraries would be estimated from this pilot project. In addition, the pilot OPT system could incorporate the data currently being gathered by Chief of Naval Operations Hazardous Materials in Specifications & Standards project.

New software would be created to interact with the foundation systems and the CDR. Software modules as described in Section 1.4.2.1 would be created where gaps exist in the foundation systems. Artificial intelligence engines in the form of rule based systems and natural language processing would be employed in the obsolescence prediction calculations as well as assisting users in querying for information.

The pilot project would be developed in a high level language which is suited for multi-platform development and operations. A high-speed, SQL based relational database system would be employed on the system containing the CDR as well as on the CUI system. All software developed would be able to be scaled up with little modification to a Navy wide environment given the available hardware resources in Phase III.

A military system such as the AEGIS/MARK 86 Gun Fire Control System, which contains mainly electronic components with

some mechanical components would be chosen to test the operation of the OPT system. The Mark 86 is a good candidate to prove the operations of the OPT system since it was originally developed over 20 years ago and is expected to be in service for the next 20 years. The Mark 86 is widely used since it is deployed on over 90% of all U.S. Naval combat ships. The emphasis of the test will be on electronic components, since according to all available research, they have the greatest problems with obsolescence. A smaller effort will be to evaluate environmental regulatory information and its interaction on the system with a selected group of mechanical parts that are seen as critical to the mission of the equipment and likely candidates for containing regulated materials.

During this pilot project details would be worked out regarding how the various sources of information to be fed into the CDR could be obtained automatically. Areas such as security, licensing, costs, data format conversions and connectivity would also be addressed. Completion of this research and the successful operation of the pilot OPT system would provide a clear path to moving into Phase III in which the OPT system is expanded across all Naval commands.

Section 2

2.1.1 ASO (Aviation Supply Office), Philadelphia, PA

SITE VISIT REPORT

CATEGORY	:	TEST SITE
COMPANY/COMMAND	:	ASO (Aviation Supply Office), Philadelphia, PA
POINT OF CONTACT	:	Tom Brown, Project Mgr. (215) 697-6676
DATE	:	7/26/1994

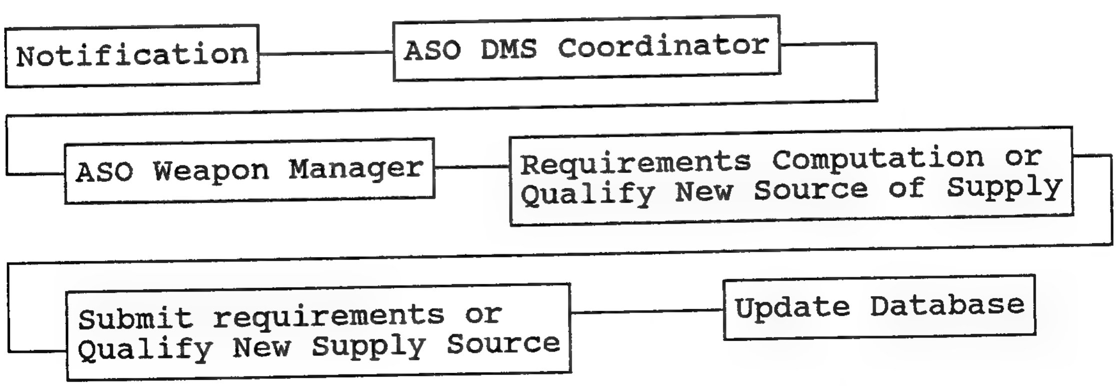
Summary

This is the first in a series of three site visit reports that will be written regarding the Aviation Supply Office (ASO) in Philadelphia, Pennsylvania which is a study test site. ASO currently has no predictive tools for the projection of DMS problems. ASO personnel have been taught how to access and use the TACTech AIM and MAX system. Two high-speed modems have been loaned for the period of the study to ASO by TACTech.

Contacts

The two key contacts for this study site are Tom Brown and In Young Choi. Tom Brown is the F/A-18 Line Item/Project Manager. His responsibilities include the tracking of discontinuance notices and life-of-type-buy notices for electronic components utilized on the F/A-18. Parts found to be on the F/A-18 are then brought to the attention of an Engineer named In Young Choi. Mr. Choi determines whether alternate sources of supply exist and recommends a course of action to be taken. His recommendations may include a LOT buy, warehouse buy, alternate manufacturer, or a redesign. This recommendation is passed back to Tom Brown.

The DMS process flow can be diagramed as follows:



Sources of Notification & Communication

90% of the notifications of discontinuance come from GIDEP, MOMS, and DESC. The remaining 10% of notices are split evenly from electronic component suppliers and internal operations such as Logistics. Once an part is designated as a DMS problem, the computer tacking system is queried to see if the same part is used elsewhere within the F/A-18. Sources of information that are used by ASO includes GIDEP, MOMS Alerts, DESC Bulletin Board, Manufacturer Data books and commercial specification books. Information can be sent and received via fax, modem, e-mail, and the Internet. Naval Message/Letter is also available. ASO track DMS problems at all levels of the weapon system, from the system level down to the component.

Current DMS Management Tools

ASO has a master information system that tracks the commonality of usage of electronic components across weapon systems that are under ASO's area of responsibility. This system does have the ability to track these components at various levels of a system's hierarchy of assemblies.

Current Environment Acceptability

According to the survey, ASO team members find the current systems for managing DMS problems to be only marginally acceptable. In all areas surveyed, improvements in processes, tools, and staffing are needed.

New Tools Recommended for Development

The following recommendations were brought forth during this site visit:

1. An information source as to who bought the last batch of parts from the original vendor before it went obsolete.

2. A system that can do Technology Assessments is needed.

3. A system that can locate alternate sources of supply including small 'sub-vendors' that may not be widely known about.

4. A system that would provide the maximum amount of time to react to a DMS situation.

5. A system that can quickly locate any "Drop-In" replacement parts that are still available.

6. A centralized information system that tracks the stocked levels of obsolete components across commands and government warehouses. This system should also track the stocked level of components at distributors or after market suppliers.

7. A system that has complete specifications for every component is needed to assist in quickly locating exact alternates.

8. A system that tracks Source Control Drawing (SCD) numbers and cross references them to vendor or military specified part numbers.

2.1.2 ASO (Aviation Supply Office)

SITE VISIT REPORT

CATEGORY	:	DoD Agency
COMPANY/COMMAND	:	ASO (Aviation Supply Office)
POINTS OF CONTACT	:	In Young Choi (215) 697-6676, Tom Brown
DATE	:	10/13/94

This meeting was held at the ASO offices located in Philadelphia, PA.

In Young Choi is an Electrical Engineer tasked with solving DMS problems for the F/A-18. Tom Brown is the Technical Manager for the F/A-18.

Although Mr. Brown has seen some DMS problems in the mechanical parts arena, most of the problems encountered by the F/A-18 are in the area of electronics and electrical components. Mechanical DMS part problems can usually be attributed to reliability problems and the lack of technical information. For example, a hydraulic actuator used on the F/A-18 became a supply problem because the manufacturer could only produce a limited quantity over a period of time. The F/A-18 program office attempted to locate a second source to meet the demand, but without the technical information, the design was proprietary to the manufacturer, the cost of reverse engineering the actuator became prohibitively expensive. In fact, the most feasible way to overcome the problem was to purchase another type of hydraulic pump that utilized different actuators. If technical information could have been obtained, an additional source most likely could have been secured.

The main factors driving mechanical DMS according to Mr. Brown were limited technical information and in some cases a limited number of suppliers. Mr. Brown expects the limiting of sources to continue and, in many cases, parts will be sole sourced as the money from the DoD gets funneled to fewer and fewer manufacturers.

A much larger problem for the F/A-18 is in the area of electronic and electrical component DMS. These categories include Integrated Circuits, Transistors, Diodes, Electromechanical, Resistors, Potting Compounds, Motors, etc.

When asked what type of information system would be of value to the F/A-18 project, Mr. Brown stated, "a system

that given a part number or National Stock Number can quickly tell me if the part is still available and who the alternate sources are if any." Mr. Choi added that information on reliability and the ability to quickly isolate possible alternatives such as GEM, MTSP, or MOSES if an alternate component is not available.

As part of this meeting, an evaluation of how well the TACTech test site was performing was conducted. The TACTech system although seen as powerful, is not being heavily utilized. The system is available currently to Mr. Choi. He pointed out that for his particular set of job responsibilities that the TACTech system was of little help. He is responsible for locating a solution when no alternate parts can be located by the IM. TACTech's system was not designed to assist in this effort, but to simply locate alternate components quickly. Thus, it was suggested that the TACTech system may fit better at the IM's desk since this is the primary job function of the IM. Mr. Choi agreed and will attempt to bring the IM up to speed on the capabilities of the TACTech system.

This intermediate result of the test site is of great value. It points out that for an automated system to be used and to be of any use, it must be placed carefully within an organization. It must "fit" within the job scope and daily workflow process if it is to be a success.

Further monitoring of the test site will be conducted before the end of this phase of the SBIR project to see how well the TACTech system was adapted into the IM's workflow.

2.1.3 ASO (Aviation Supply Office)

SITE VISIT REPORT

CATEGORY : DoD Agency
COMPANY/COMMAND : ASO (Aviation Supply Office)
POINTS OF CONTACT : In Young Choi (215) 697-6676,
DATE : 01/07/95

This meeting was held via telephone with In Young Choi. Since the transfer of the test site software to the IM department there has been very little use.

Lack of proper training combined with a misunderstanding as to the capabilities of the test site system are seen as the main reasons for the low usage pattern. The need for training can't be emphasized enough for a sophisticated system such as TACTech's. The move to a graphic user interface should reduce the amount of training required and create a more 'user-friendly' environment.

2.1.4 DCSC (Defense Construction Supply Center), Columbus, Ohio

SITE VISIT REPORT

CATEGORY	:	DoD Agency
COMPANY/COMMAND	:	DCSC (Defense Construction Supply Center), Columbus, Ohio
POINTS OF CONTACT	:	David McCrary, (614) 692-1082
DATE	:	12/18/94

This meeting was held over the telephone with David McCrary on December 18, 1994. Mr. McCrary heads up the DMSMS effort for DCSC in Columbus, Ohio. DCSC is responsible for managing components such as bearings and electric motors.

Mr. McCrary says that DCSC has experienced almost no DMSMS problems. He said that they are almost always able to locate another source of supply for a manufactured part, or make a life-buy of the part if absolutely necessary. An example given was that of an obsolete electric motor. DCSC had located a supplier of motors that was willing to place a motor that they manufacture into a housing that was designed for a now obsolete motor, thus solving the DMSMS problem. Mr. McCrary did suggest that he expects to see DMSMS problems increase over time as weapon platforms age and are kept in service longer. But this increase should be minimal.

Most availability problems facing DCSC today are due to small quantity order that are no-bid by the manufacturer. These problems are usually easily solved.

2.1.5 Department of the Navy, F/A-18, Arlington, VA

SITE VISIT REPORT

CATEGORY	:	DoD Agency
COMPANY/COMMAND	:	Department of the Navy, F/A-18, Arlington, VA
POINT OF CONTACT	:	Bill Taylor, (703) 604-2210 ext.740
DATE	:	9/14/94

The F/A-18 program is an excellent case study in the life cycles that a military program goes through. The original production of F/A-18 fighters started back in 1983. 400 planes of the A/B type were constructed. Since then the A/B version production has ceased after being replaced with the C/D version. There are currently 500 C/D planes built and another 100 to be completed. The E/F version of the F/A-18 is slated to enter production in 1995. This one program has planes that are now facing a growing DMS problem, planes that are currently in production, and planes on the drawing board/testing phase.

Lessons learned from waste that occurred in the transition from the A/B to the C/D production are now being put into practice in the upcoming transition to the E/F production. DMS problems detected in the logistical support of the A/B and C/D versions of the F/A-18 are being carefully studied to reduce the impact of DMS on the future E/F versions. The E/F versions will eventually replace all of the A,B,C,D versions of the F/A-18.

To assist in the tracking of individual components within the F/A-18, changes to the aircraft are kept at a "Lot" level if at all possible. Each year of production is considered a "Lot." If the changes can't wait due usually to upgrades or the unavailability of an item, it can take place between "Blocks" of which there are three per production year. This limiting of changes makes it easier to track down aircraft that utilize variations of components. For example, if a Life-time-buy of a particular component comes up, the F/A-18 program office can track the usage of that component to a group of aircraft that were produced within a block or lot. In this manner they can then notify the purchasers of those aircraft in hopes of consolidating a Lifetime purchase of the DMS component.

The F/A-18 program office in combination with its prime contractor McDonnell Douglas utilize the TACTech electronic parts DMS prediction system for F/A-18 avionics. Each system of the C/D versions are being analyzed to detect it's DMS vulnerability before it is

placed into the E/F version design. New designs are also being checked for designed-in DMS problem components. In this way the F/A-18 program office is attempting to keep DMS problems to a minimum on the F/A-18 E/F while it is in production.

Unfortunately no similar tool exists for the mechanical components on board the F/A-18 according to Mr. Taylor. A major problem as stated by Mr. Taylor with solving mechanical part discontinuance is that level 3 drawings and the rights to use them are rarely purchased at the time of contract award. Thus if a manufacturer decides to "no-bid" an item, it is more difficult and costly to replace that item from another manufacturer.

High precision gears is one recent area of DMS that has effected the F/A-18. The F/A-18 uses these gears in a transmission box that is driven from the F/A-18 engines. The gears in this box rotate at extremely high speed for long periods of time. The manufacturer "no-bid" additional parts and thus a search was begun to locate another qualified supplier. It was a surprise to many to find out that an estimated 75% of the manufacturing base of high precision gears had gone out of business due to the cutbacks in production at the Department of Defense. The few remaining suppliers were located in the western United States. Fortunately for the F/A-18 production, one supplier was capable and willing to make the gears.

The loss of our military production base at the sub-tier contractor level is not being currently monitored. Whole industries are disappearing or moving off-shore. This trend will continue as DoD production remains low. A continuing increase in DMS problems for mechanical parts is to be expected.

The F/A-18 is attempting to incorporate where possible the concepts of using NDI (Non Developmental Items). A commercially available flight recorder is undergoing testing for use in the F/A-18. This recorder costs approximately $1000, estimated to be less than a third of the cost of having a recorder specifically built for the F/A-18 E/F. According to Mr. Taylor there must be a change in thinking when it comes to supporting an NDI item. That is that the lower costs enable the Navy to throw away older versions of the unit when they are no longer easily repaired. The Navy can then replace those units with the commercial manufacturer's new units. In many cases it is cheaper to take this "commercial" approach to supporting the item than to try to keep an antiquated unit operational with costly repairs.

2.1.6 DESC (Defense Electronics Supply Center), Dayton OH

SITE VISIT REPORT

CATEGORY	:	DoD Agency
COMPANY/COMMAND	:	DESC (Defense Electronics Supply Center)
POINTS OF CONTACT	:	Bill Smith, James Nessler
DATE	:	9/30/94

This meeting was held at the Defense Electronics Supply Center in Dayton, Ohio. In attendance were Bill Smith who heads up the DMSMS group at DESC and James Nessler that assists Mr. Smith.

Mr. Smith noted that the greatest DMSMS problems facing the military are electronic components due to the shear volume of parts becoming obsolete each year. The main reason for this trend is the extremely competitive commercial and global electronics marketplace, according to Mr. Smith.

DESC handled over 4,100 DMSMS parts last year. 12 of DESC's staff are dedicated full time to tracking and handling DMSMS problem components. Fiscal 1995 is expected to be a record setting year due to large electronics manufacturers exiting the military marketplace. DESC is a reactive organization both in design and in funding. There charter is to react to DMSMS problems brought to them by various military program offices.

The toughest problems faced by DESC is the lack of accuracy of the number of parts to be purchased for an end of life buy. The lack of accuracy is due to a lack of feedback from the services that include redesigns, scrap, cannibalization and chronological MTBF (Mean Time Before Failure) increases. This is compounded by the reductions in systems operations due to reduced steaming and flying time, according to Mr. Nessler. DESC is limited by Congressional Mandate to purchase no more than a two years supply of parts. Due to the much greater expense involved in redesigning a system or the cost to emulate a microcircuit, Mr. Nessler reasoned that even if some parts are thrown away, it is still cheaper to do a life of type buy as the solution to a pending obsolescence problem.

DESC utilizes a database called the 'DMS' file. This database contains warehousing and distribution data for the Ogdon and Richmond DLA facilities. It also contains a cross reference from National Stock Numbers to manufacturer parts.

Individual program managers have the responsibility for long-term DMSMS support of their programs. DESC responds to the needs of the various managers by purchasing inventories of electronic parts with DLA monies. These parts are then stocked at a DLA warehouse. DESC is also responsible for testing parts that are to be added to the warehouse and checking aging parts to see if they still meet design specifications. DESC's goal is to have parts on hand such that redesign efforts are never based on a lack of parts. Redesigns will always be popular according to Mr. Nessler. This is due to the way the 'system' works. There is more money in it for the contractors to redesign a piece of electronic gear than to just repair it. And the program offices are motivated to do redesigns to increase the performance characteristics of the equipment.

Some recommendations made by Mr. Smith and Mr. Nessler regarding how communications with DESC could be improved are:

1. To have a consolidated Weapon Systems File. This file would include all services' programs and all contractors parts lists.

2. To get direct communications with where the part is used which would provide more timely feedback.

3. Improved feedback (closing the loop) from services regarding accurate estimates of life-time-buy requirements.

2.1.7 DISC (Defense Industrial Supply Center), Philadelphia, PA

SITE VISIT REPORT

CATEGORY	:	DoD Agency
COMPANY/COMMAND	:	DISC (Defense Industrial Supply Center), Philadelphia, PA
POINTS OF CONTACT	:	Bill O'Neil David Rivers (215) 697-6853
DATE	:	10/13/94

This meeting was held at the DISC offices located in Philadelphia, PA.

Bill O'Neil is the DMS Chairman for the Defense Industrial Supply Center, DISC. David Rivers assists Mr. O'Neil with solving DMS cases as well as determining projected manufacturing capacities in times of crisis.

The DISC has the responsibility of interfacing between DLA's inventory system and DoD agencies regarding the procurement of mechanical parts. These parts include pulleys, nuts, bolts, retaining rings, o rings, circuit breakers, etc. Usually the parts could be categorized as simple mechanical components.

According to Mr. O'Neil, DISC has had a total of 47 DMS cases within the past 4 years. Most of those cases involved circuit breakers that the Navy wanted procured for a life-of-type-buy.

DISC evaluates requests for life-time-buys from agencies and then passes its recommendations on to DLA which procures and stores the parts for later use by the agencies.

Almost all of the requests made by an agency are in response to a discontinuance notice from a supplier. DISC's job is to locate, if possible, alternate sources of supply. Most of the time this involves looking the parts up in a system called SAMMS (Samstel Automated Material Management System). From SAMMS, all of the prior purchases of the components can be located along with the suppliers of the component. Many times an alternate supplier is readily available. Further checking is done to ensure that the supplier is still able to make the component and the recommendation back to the DoD agency is to procure future needs from that supplier. If no other suppliers are listed in SAMMS, then a search through Haystack or through an internal database of suppliers that

make similar parts is conducted. In almost all cases another supplier is found that is able and is willing to make the part. This process avoids a costly life of type buy. When asked why DISC has had so few DMS cases, Mr. O'Neil responded that the parts his organization deals with are so simple it is not difficult to find someone else who can supply them. Future DMS cases are expected to increase due to the shrinking industrial base. But this problem is not seen as insurmountable.

The biggest problem seen by Mr. O'Neil and Mr. Rivers with regards to DMS is that the rights to the drawings are many times held by a manufacturer, making it more difficult to have another manufacturer make the same component.

Another problem is the loss of visibility of the actual suppliers since some of the parts are being procured through dealers and distributors. This loss of visibility masks what is really taking place within the sub-tier suppliers.

DMS for mechanical parts is driven mainly by the lack of a market, thus forcing the manufacturer to retool. This retooling makes that ability to produce the original parts difficult, expensive, or no longer possible.

One key point made by Mr. O'Neil, is that even though a generator is a DMS problem, no longer made, the parts that go into the generator many times are not. For example, the screws that hold the generator's housing together can still be easily procured.

On a periodic bases, DISC does collect information from manufacturers as to their ability to produce parts in a wartime situation. This information is used to check our readiness and ability to support a war effort if the need arose. This broad survey helps to pin-point areas where manufacturing capacity may be lacking.

2.1.8 DLA-DSIO (Defense Logistics Agency),(Defense Spares Initiative Office)

SITE VISIT REPORT

CATEGORY	:	DoD Agency
COMPANY/COMMAND	:	DLA-DSIO (Defense Logistics Agency), (Defense Spares Initiative Office)
POINTS OF CONTACT	:	Phil Clark (703) 274-6451, Peter Holbrook (703) 697-0345
DATE	:	9/14/94

This meeting was held at the DLA offices located in Alexandria, VA.

Peter Holbrook heads up the setting of DMS policies throughout the DoD. Mr. Holbrook is actively involved in promoting and modifying DMS policies as they relate to DoD programs. A full section on DMS is an example of his efforts in the Logistic Guidance 4140.1R. Mr. Holbrook sees no changes in the near future to DMS policies. This is due to the fact that pressure to expand the policies is balanced by pressure to reduce DMS policies.

Phil Clark heads up the DMS efforts at DLA. DLA is responsible for supplying the consumable part needs of over 1400 different types of equipment. There are approximately 40,000 modification kits that are used to update an end-item from one revision to another. These kits are tracked by DLA as well. DLA supplies over 4.6 million consumable items. These include electronic parts, mechanical parts, and all other types of parts and materials that need replacing with the use of the equipment.

The development of improved DMS reactionary tools was discussed. The need for feedback support of changes to fielded systems is seen as crucial for determining the accuracy of future life-time-buys. Today, many of the changes that take place to fielded systems and the contents of the modification kits that are used, are not recorded.

DMS would be an easier problem to solve if all parts, down to the component level of a fielded system, were constantly tracked. This includes spares as well. Extensive tracking would allow for very accurate visibility of life-time-buy opportunities and the calculations for long-term support quantities. This information could be tied into a DMS predictive tool in that parts that are vulnerable to DMS would be easily located across weapon systems.

Intensive tracking is rarely done due to the costs involved. One benefit of a DMS predictive tool might be that it could point out commodities that should be tracked. The focusing of the tracking effort would reduce the costs involved while maximizing the benefits gained. Mr. Holbrook and Mr. Clark agreed that mechanical devices' obsolescence is a result of EPA regulatory pressures, economic pressures due to the downsizing of the DoD, and technology shifts. Phil Clark pointed to RAMP (Rapid Acquisition of Manufactured Parts) as an example of how DMS within mechanical parts is being solved currently. Since many times level 3 drawings (detailed enough to make it possible to build the part) are rarely purchased, RAMP has the ability to reverse engineer a part and then produce the part at its facility.

Mr. Clark suggested that trend data available from industrial organizations may provide clues as to the prediction of DMS for mechanical parts. Industrial organizations will be contacted as part of this study.

2.1.9 DMSMS Working Group Meeting Held at NUWC, Keyport, WA

SITE VISIT REPORT

CATEGORY	:	Working Group Meeting
COMPANY/COMMAND	:	DMSMS Working Group Meeting Held at NUWC, Keyport, WA
POINTS OF CONTACT	:	Judy LaFountaine
DATE	:	9/20/94 - 9/24/1994

Several interesting presentations were delivered at the DMSMS working group meeting held at Keyport.

One was presented by Nathaniel Green of Industrial Analysis Support. The Industrial Base Assessments that his group is doing on a regular basis provide detailed information down to the manufacturing facility level. The information collected includes manufacturing facility capacity both currently and projected, the value of shipments from the facility to both the DoD and Commercial accounts, future plans of the manufacturer regarding the facility, and statistical information regarding current production parameters. Many other items are collected as well. This information would be of great value in developing a prediction system with early warning capabilities. A meeting was set for early October to pursue how the Industrial Analysis Support group may be able to participate.

Harold Schmidt, an attendee brought up a good example of DMS obsolescence of materials. He reported on the need to stock-pile CFC's for certain weapon systems, an example was the cooling of wave guides for communications. CFC's have been banned by the EPA and thus manufacturing capacities have been turned towards making other products. The tracking of EPA regulatory trends lead the DoD to make an assessment of long-term needs and then to stock-pile the estimated quantities.

The Information and Communications Subcommittee was putting the final touches on the DMSMS database system that is to be housed at GIDEP. This system will allow for the creating of a repository of DMSMS problems and solutions. The concept is that various DoD agencies will place DMSMS problems that they encounter into the repository. Other agencies who have yet to detect a similar problem will then be notified and have the opportunity to collaborate on solving the problem. As a history of problems and solutions are placed in the system, future DMSMS problems could be solved by simply finding out how others had solved the problem previously.

The database design incorporates many very good features. These include the ability to upload and download information in an automated manner. For example it should be possible to have a computer system automatically search the repository for DMSMS cases that effect the design of a weapon platform that is being monitor for DMS. It should be possible to feed discontinuance notices from the GIDEP system directly into a prediction system. Early warning of a manufacturer's discontinuance of similar items may add another dimension to the prediction tool.

The DMSMS repository will only be as good as those who cooperate by feeding DMSMS cases into it. The greater number of submissions, the greater the possibility of amortizing the solution costs across multiple programs or agencies.

The DMSMS repository also has the limitation that unless there is a common part numbering scheme, every one calling a part by the same number, it will be difficult for users to share information on similar problems. The database design has an NSN (National Stock Number) field, but a great number of parts that are having DMSMS problems are non-NSN parts. Non-NSN parts are those that are considered to be non-consumable. Any part that is not expected to have to be replaced is in this category. Many mechanical devices fall into this category. The Generic part number field may provide an answer as long as some standardization is made known and adhered to.

2.1.10 DTC (DMS TECHNOLOGY CENTER), NSWC Crane, IN, & NAWC Indianapolis, IN

SITE VISIT REPORT

CATEGORY	:	DoD Agency
COMPANY/COMMAND	:	DTC (DMS TECHNOLOGY CENTER), NSWC Crane, IN, & NAWC Indianapolis, IN
POINTS OF CONTACT	:	Jim Peters, NAWC-DTC, Doug Hayes, NSWC-DTC
DATE	:	9/29/94

This meeting was held at Vitro's facility (a contractor to the DTC) in Bloomington, IN. In attendance was Jim Peters of NAWC-DTC and Doug Hayes, who works for Vitro and is assigned to NSWC-DTC as a software developer and systems administrator.

The DMS Technology Center (DTC) is a cooperative effort between The Naval Avionics Center at Indianapolis, Indiana and the Naval Surface Warfare Center located at Crane, Indiana. NSWC main area of expertise is the tracking and solving of DMS problems at the electronic component level. NAWC's expertise is in a top down approach to DMS through a group there called HONE (Health of Naval Equipment). The HONE group analyzes the needs of the Navy by looking at the equipment and weapon platforms the equipment is on. HONE takes into account the expected life of the various pieces of equipment and also if the function of the equipment is to be replaced in the next few years.

It is by combining this high level overview of equipment service life demands with a low level analysis capability of the equipment that a complete picture of the DMS problems and their optimal solutions can be developed. The HONE group can focus DMS problem solving efforts to those pieces of equipment that are essential to the ongoing mission of the Navy. This ability to focus on the key equipment can save countless hours that could be easily wasted solving DMS problems for equipment that is being phased out.

HONE was originally called HONA (Health of Naval Aviation). HONA's main focus was on airframes and engines. Having found that DMS problems in these categories were minimal as compared to electronic device DMS, HONE changed its emphasis to electronic equipment. According to Jim Peters, parts lists are the Achilles heel of DMS detecting and problem solving. As NSWC improves in its ability to obtain, clean-up, and analyze parts lists, HONE's focus is shifting from strictly top-down, high level data to the module and component level.

HONA originally gathered data from existing sources in order to avoid creating another data gathering intensive operation. HONA, now HONE tracks information down to the "tail-number" of individual aircraft. Thus, HONE can determine in exactly what aircraft a particular system is used. HONE data covers such areas as MTBF, MTTR, cost per flight hour, cost to repair, navy mission directions, and design-in/replacement schedules.

Jim Peters stated that what is needed is a streamlined alert process. Perhaps bringing more automation to the GIDEP system upon which data transfer could easily be accomplished to and from GIDEP's alert system. Other computers would be able to automatically dump new alert information to the GIDEP repository and they would also be able to search the alerts and repository without human intervention. An optimal system would provide continual monitoring of DMS alerts and their impact on equipment.

Mr. Peters stated that 85% of military equipment is now out of production and thus there is no longer a prime contractor which was a central focal point for knowledge and information as to how to build and maintain the equipment. The ongoing logistics responsibility end up being managed by a government agency and some key pieces of information are usually lost in the transfer.

Decision tools, those programs that assist a DMS problem solver by providing key information in an easy to access format are the key according to Mr. Peters. He stated, "We really don't know how many of what we have," and "We don't know where the spares are." These pieces of information are critical to selecting the most cost effective solution to solve a DMS problem.

Doug Hayes provided an overview of the current status regarding NSWC's computer system. NSWC's computers currently are based on a client/server architecture of SUN Microsystems workstations and 486 based personal computers. The PC's are running windows and new software for the tracking of DMS cases is in the process of being built using Microsoft Access. Eventually the goal is to provide a system by which other commands that are having the DTC monitor and alert them to DMS problems will be able to call up the NSWC system and obtain status information regarding their program.

Further research on HONE and its current capabilities will be done in a future site visit.

2.1.11 DTC-HONE (DMS TECHNOLOGY CENTER), (Health Of Naval Equipment), NAWC Indianapolis, IN

SITE VISIT REPORT

CATEGORY	:	DoD Agency
COMPANY/COMMAND	:	DTC-HONE (DMS TECHNOLOGY CENTER), (Health Of Naval Equipment), NAWC Indianapolis, IN
POINTS OF CONTACT	:	Mike McLeish, NAWC-DTC, David Devine, NAWC-DTC, Bill Krug, NAWC-DTC
DATE	:	9/30/94

This meeting was held at NAWC, Indianapolis, Indiana. In attendance was David Devine, Mike McLeish, and Bill Krug who each hold the title of HONE Analyst and head up the HONE effort at NAWC.

The HONE group analyzes the needs of the Navy by looking at the equipment and weapon platforms the equipment is on. HONE takes into account the expected life of the various pieces of equipment and also if the function of the equipment is to be replaced in the next few years.

It is by combining this high level overview of equipment service life demands with a low level analysis capability of the equipment that a complete picture of the DMS problems and their optimal solutions can be developed. The HONE group can focus DMS problem solving efforts to those pieces of equipment that are essential to the ongoing mission of the Navy. This ability to focus on the key equipment can save countless hours that could be easily wasted solving DMS problems for equipment that is being phased out.

For more information on the history of the HONE Program, please refer to 2.1.10.

Current work in progress by the HONE group includes an analysis of the BSY-1 combat system that is in operation aboard Los Angeles Class submarines. The BSY-1 weighs in at over 32 tons and includes over 40 cabinets with a couple hundred circuit cards per cabinet. This equates into literally thousands of electronic components.

David Devine emphasized that HONE's approach to DMS is unique in that they are really looking at the cost of ownership as the main driver. For example, if a circuit card has a very short MTBF, and it is either time consuming or expensive to repair the item, then a redesign may be a more cost effective fix over the long run.

Another example of HONE's abilities is regarding the ARC-182 radio. This radio was being phased out of use in the F/A-18 by the ARC 210. The ARC-182's that were pulled out could be used within 10 other types of aircraft. Thus instead of purchasing new radios and components, these ARC-182 could be used to sustain operations.

Included in this report is an example of a report from the HONE program. The HONE report is for the ARC-182 and includes a VAMOSC (Visibility and Management of Operations and Support Costs) summary, an ARC-182 summarization sheet, and a chart of where candidates which could be slated for early removal. Most of the data is gathered from readily accessible, government databases such as ICPNET, and DLA files. Other data sources include contractors. Cooperative sources of data are essential to fill in the gaps left by government databases.

HONE has developed a chart called the "Platform Obsolescence Degradation Tree." This chart has been included in this report. Platform obsolescence is seen as coming from a degraded mission capability which in turn as a result of Supportability Degraders and Reliability Degraders. Supportability Degraders are the result of either the inability to buy or the inability to repair the part where Reliability Degraders are a result of a lengthy repair time or a high failure rate. This view of obsolescence brings into the picture the reliability side of the equation. This perspective on obsolescence is broader than most of those that have been interviewed to date.

Another chart from HONE is the "DTC ENTERPRISE PROCESS." This chart shows the process by which a project flows through the DTC. Of special note is the third box down from the top. At this stage in the process, two types of analysis is conducted, a materials based maintenance and obsolescence analysis and a functional bases maintenance Obsolescence analysis. The materials based analysis is focused on the equipment itself where as the functional looks at such factors and MTTR, MTBF, equipment and platform phase out, and projected redesign efforts.

The last chart of interest is the "TECHNOLOGY MANAGEMENT - NAVAL AVIATION EXAMPLE." In this chart 155 aircraft types were identified which ultimately translates to the usage of over 10,000 unique integrated circuits.

HONE's broad perspective on Obsolescence cannot be easily dismissed. A consecutive top-down and bottom-up approach adds a degree of safety that the final solution chosen is appropriate for the situation. An automated DMS predictive tool should incorporate both perspectives to be effective.

Oct. 91 - Sept

VAMOSC SUMMARY

Selected TEC's and Selected Equipments

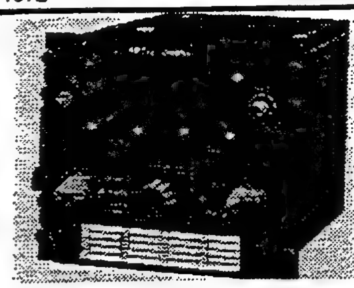
AIRCRAFT: F-14A   TYPE EQUIPMENT: AFWA   NUMBER OF AIRCRAFT REPORTING IN FY92: 318   FLIGHT HOURS: 72725.4

NUMBER OF AIRCRAFT PROJECTED IN FY94: 272

WUC	Nomenclature	Unscheduled Cost $K Consum	Unscheduled Cost $K Labor D	Unscheduled Cost $K Labor I	Scheduled Cost $K Consum	Scheduled Cost $K Labor D	Scheduled Cost $K Labor I	Total Cost	UnSch MA	UnSch FA	Sch MA	Sch FA	Cost per Failure	Cost per Aircraft	Cost per Flight Hr	Unschedule MFHBF	Unschedule MFH
51000	INSTRUMENTATION SYSTEMS	0	1	0	0	0	0	$1,000	17	6	0	0	$167	$3	$0	12120.8	4
51F10	INSTRUMENT SYSTEM	0	5	0	0	0	1	$6,000	52	21	15	0	$238	$19	$0	3463.1	1
51F11	PITOT STATIC INSTALLATION	51	26	1	4	0	2	$84,000	134	83	50	11	$928	$266	$1	876.2	5
51F12	COUNTING ACCELEROMETER INSTALLATION	4	3	2	0	0	0	$9,000	44	28	6	1	$250	$28	$0	2597.3	1
51F19	NOC	2	2	1	0	0	0	$5,000	17	6	1	0	$667	$16	$0	12120.8	4
51R10	STANDARD RELATED INSTRUMENTS	4	2	2	0	0	0	$8,000	22	10	7	0	$600	$25	$0	7272.5	33
51R15	AIRSPEED/MACH INDICATOR	66	108	10	1	0	2	$187,000	781	460	21	5	$378	$592	$3	158.1	
51R19	NOC	0	0	0	0	0	0	$0	2	1	3	2	$0	$0	$0	72725	363
51R1A	RATE OF CLIMB/VERTICAL VELOCITY IND	32	36	13	0	0	0	$81,000	289	191	8	4	$356	$256	$1	380.8	2
51R20	STANDARD RELATED INSTRUMENTS (CONTD)	1	1	1	0	0	0	$3,000	12	5	3	2	$400	$9	$0	14545	60
51R24	MS25448( ) COUNTING ACCLRM INDICATOR	11	22	4	1	0	0	$38,000	56	40	16	5	$625	$120	$1	1818.1	12
51R29	NOC	0	4	0	0	0	0	$4,000	1	1	0	0	$4,000	$13	$0	72725	72
51R2C	MS25447( ) COUNTING ACCLRM TRANSDUCER	18	5	4	1	0	0	$28,000	24	22	8	7	$1,045	$89	$0	3305.7	30
51X10	STANDARD ASSOCIATED INSTRUMENTS	6	9	2	0	0	0	$17,000	53	34	5	0	$441	$54	$0	2139	13
51X11	AAU19( )/A CNTR DRUM POINTER SVO ALTM	204	120	86	4	1	2	$417,000	608	458	14	7	$707	$1,320	$6	158.6	11
51X15	AAU3( )/A ALTIMETER	102	67	42	0	0	0	$211,000	391	257	13	4	$658	$668	$3	283	
51X19	NOC	0	1	0	0	0	0	$1,000	12	6	3	1	$167	$3	$0	12120.8	60
51X1J	AQU5/A STANDBY COMPASS	16	13	1	1	0	1	$32,000	206	155	16	5	$187	$101	$0	469.2	:
51X1M	AVU24/A AIRSPEED MACH INDICATOR	42	53	8	1	0	0	$104,000	386	223	6	3	$426	$329	$1	326.1	18
51X1R	ARU38/A TURN/SLIP INDICATOR	4	21	0	0	0	2	$27,000	114	82	2	2	$305	$85	$0	886.9	63
51X1S	ABU4( )/A ACCELEROMETER	28	9	5	0	0	0	$42,000	77	62	1	1	$597	$133	$1	1173	94
51X1W	ABU11/A CLOCK	53	124	15	0	0	1	$193,000	1263	903	26	17	$196	$611	$3	80.5	5
51X20	STANDARD ASSOCIATED INSTR (CONTD)	0	0	0	0	0	0	$0	4	2	0	0	$0	$0	$0	36362.5	1818
51X2F	TRU145/A ACCELEROMETER TRANSMITTER	18	4	2	0	0	0	$24,000	19	16	0	0	$1,375	$76	$0	4545.3	382
51X2N	ID2260/A CAUTION-ADVISORY INDICATOR	18	20	2	1	0	0	$41,000	173	127	10	6	$299	$130	$1	572.6	42
51X2P	ID2261/A CAUTION-ADVISORY INDICATOR	1	2	0	0	0	0	$3,000	22	13	0	0	$231	$9	$0	5594.2	330
51X2Q	ID2262/A CAUTION-ADVISORY INDICATOR	0	0	0	0	0	0	$0	5	4	0	0	$0	$0	$0	18181.3	145
51X2R	ID2263/A CAUTION-ADVISORY INDICATOR	0	0	0	0	0	0	$0	1	0	0	0	$0	$0	$0	0	727
51X2S	ID2264/A CAUTION-ADVISORY INDICATOR	0	0	0	0	0	0	$0	1	0	0	0	$0	$0	$0	0	727
51X30	STANDARD ASSOCIATED INSTR (CONTD)	0	0	0	0	0	0	$0	3	1	0	0	$0	$0	$0	72725	24241
51X3F	ID2470/A CONTROL-ADVISORY INDICATOR	0	0	0	0	0	0	$0	2	1	1	1	$0	$0	$0	72725	36362
51X3G	ID2471/A CONTROL-ADVISORY INDICATOR	0	0	0	0	0	0	$0	3	1	0	0	$0	$0	$0	72725	24241
51X3H	ID2473/A BACK UP OXY SYS PRESSURE IND	0	1	0	1	0	0	$2,000	6	4	1	1	$250	$6	$0	18181.3	12120
51X3J	ID2482/A ANGLE INDICATOR	0	2	0	0	0	0	$2,000	16	12	1	1	$167	$6	$0	6060.4	4545
541D2	C-BAND TRANSPONDER (DKT-56)	0	0	0	0	0	0	$0	3	1	0	0	$0	$0	$0	72725	24241
56000	FLIGHT REFERENCE SYSTEMS	0	1	0	0	0	0	$1,000	14	8	5	5	$125	$3	$0	9090.6	5194
562F0	AN/ASN116( ) ATTD-HEADING REF SET	0	2	0	0	0	0	$2,000	22	11	0	0	$182	$6	$0	6611.4	3305
562F4	CN1492/ASN116 ELEK COMPASS COMP	2	15	1	0	0	0	$18,000	24	16	1	0	$1,063	$57	$0	4545.3	3030
562F9	NOC	0	0	0	0	0	0	$0	5	3	1	1	$0	$0	$0	24241.7	1454

Nomenclature	WUC	Type	Vintage	Manufacturer
AN/ARC-159	632Z	UHF Radio	1972	Rockwell Collins

The AN/ARC-159()(V)() UHF Radio System is a family of AM Radio installation sets providing for both panel and remote mounting. Since this is a solid-state radio, a variety of mounts were made to allow the ARC-159 to replace the ARC-27, ARC-34, ARC-51, ARC-52, and ARR-69 radios. The AN/ARC-159 was reported by 46 Type/Model/Series Naval aircraft in 1992. The 3M anomaly the base unit not having an 'RT-XXXX' nomenclature in the Work Unit Codebook has caused much mis-reporting. The ARC-159 is being replace in many applications by the AN/ARC-182, and soon, the AN/ARC-210. The ARC-159 is manufactured by Rockwell Collins, Cedar Rapids, IA.



REPORTING AIRCRAFT/POINTS OF CONTACT

TMS	CFA POC	Location	Phone
* A-4E			
A-4M			
AH-1J			
C-130T			
* CH-53E	R.C. Hill	NADEP PNCLA	(904) 452-3587
EA-6A			
* EA-7L			
* EP-3J			
F-14B	Chief Koch Code 049	NADEP Norfolk	(804) 444-8148
* HH-1K			
KA-6D			
KC-130R			
LC-130F			
* NA-6E			
* NTA-4J			
RH-53D			
SH-2G	Larry Locklar Code 33400	NADEP PNCLA	(904) 452-3584
* SH-3G			
SH-60B	Cheryl Key	NADEP PNCLA	(904) 452-8544
TA-4F			
TA-7C			
UH-1N	Larry Locklar Code 33400	NADEP PNCLA	(904) 452-3584
* UH-60A			

TMS	CFA POC	Location	Phone
A-4F			
A-6E	Barry Weinstein	NADEP Norfolk	(804) 444-8881
C-130F			
C-2A	Keith Christian Code 332	NADEP North Island	(619) 545-7745
E-2C	Keith Christian Code 332	NADEP North Island	(619) 545-7745
EA-6B	Barry Weinstein	NADEP Norfolk	(804) 444-8881
* EC-130Q			
F-14A	Chief Koch Code 048	NADEP Norfolk	(804) 444-8148
* F-4S			
HH-1N			
KC-130F			
KC-130T			
LC-130R			
* NTA-4F			
* OF-4N			
SH-2F	Larry Locklar Code 33400	NADEP PNCLA	(904) 452-3584
* SH-3D			
SH-3H			
T-2C			
TA-4J			
* TC-130G			
* UH-3A			

* Installation not verified

EQUIPMENT WRA BREAKDOWN

WUC	Nomenclature	SM&R	Part Number
6322000	AN/ARC159( )(V)( ) RADIO SYSTEM		
6322300	MT4609/ARC159(V) ELEC EQPT MTG BASE	PAOGG	622-1025-001
632Z600	RT1150/ARC159(V) RECEIVER XMTR	PAOGD	622-1365-001
632ZB00	ID1972/ARC159(V) FREQ CHAN INDICATOR	PAOGD	622-1624-001
632ZE00	MT4658/ARC159(V) ELEC EQPT MOUNT BASE	PAOZZ	622-1358-001
632ZG00	MT4660/ARC159(V) ELEC EQPT MOUNT BASE	PAOGG	622-1751-001
632ZJ00	MT4662/ARC159(V) ELEC EQPT MOUNT BASE		
632ZL00	MT4664/ARC159(V) ELEC EQPT MOUNT BASE		
632ZN00	SA1964( )/ARC159(V) SWITCHING UNIT	PAOGD	622-0958-001
632ZQ00	C9952( )/ARC159(V) RADIO SET CONTROL	PAOGD	622-2250-001
632ZS00	C9954( )/ARC159(V) RADIO SET CONTROL		
632ZV00	MT4795/ARC159( )(V) MOUNT	PAOGD	622-2259-001
632ZX00	RT1194/ARC159( )(V) RCVR TRANSMITTER	PAOGD	622-1366-001
632ZZ00	SA2078/ARC159(V) SWITCHING UNIT	PAOGD	
633A100	ID1984/ARC159(V) FREQ CHAN INDICATOR	PAOGD	622-2038-001
633A300	CV3328/ARC159(V) D TO D CONVERTER	PAOGD	622-2444-001
633A700	PP7323/ARC159()(V) POWER SUPPLY		
633AA00	HD1001/ARC159()(V) ELEC EQPT COOLER		
633AC00	MT4840/ARC159()(V) ELEC EQPT MOUNT		
633AE00	C10436()/ARC159()(V) RADIO SET CONTROL	PAOGD	622-0629-003
633AG00	AS3668/ARC159(V) ANTENNA		
633AJ00	MT6093/ARC159(V) ELEC EQPT MTG BASE	PAOGD	622-5201-001
632Z100	UHF TRANSCEIVER	PAOGD	
632Z400	C9451/ARC159( )(V)( ) RADIO SET CONT	PAOGD	622-1006-001
632Z800	RT1151/ARC159( ) RECEIVER TRANSMITTER		
632ZC00	C9577( )/ARC159(V) RADIO SET CONTROL	PAOGD	622-0629-001
632ZF00	MT4659/ARC159(V) ELEC EQPT MOUNT BASE	PAOGG	622-1750-001
632ZH00	MT4661( )/ARC159(V) ELEC EQPT MTG BASE	PAOGG	622-2314-001
632ZK00	MT4663/ARC159(V) ELEC EQPT MOUNT BASE		
632ZM00	PP7095/ARC159(V) POWER SUPPLY	PAOGD	622-2037-001
632ZP00	C9951( )/ARC159(V) RADIO SET CONTROL	PAOGD	622-2249-001
632ZR00	C9946( )/ARC159(V) RADIO SET CONTROL	PAOGD	622-2251-001
632ZT00	C9815/ARC159( )(V)( ) RADIO SET CONT	PAOGD	622-2287-001
632ZW00	F1420/ARC159( )(V) FILTER		
632ZY00	C9960/ARC159(V) RADIO SET CONTROL	PAOGD	622-2441-001
633A000	AN/ARC159()(V)() RADIO SYS		
633A200	ID2053/ARC159() FREQ CHAN INDICATOR	PAOGD	622-2443-001
633A500	C9816/ARC159()RADIO SET CONTROL	PAOGD	622-2287-002
633A900	NOC		
633AB00	MT4839/ARC159()(V) ELEC EQPT MOUNT		
633AD00	MT4760()/ARC159()(V) ELEC EQPT MOUNT	PAOZZ	622-1358-002
633AF00	CN1596/ARC159(V) EMP SUPPRESSOR ASSY		
633AH00	TD1385/ARC159(V) DIPLEXER		
633AK00	F1603/ARC159(V) BAND PASS FILTER		

FUNCTIONAL CHARACTERISTICS

Frequency Range	Channel Spacing	Modulation	Voice	Data	Secure	Power Out	ALE Option
225/400 MHZ	25 KHZ	AM	Yes	No	Yes	10 W	NA

AN/ARC-159

Microcircuit Obsolescence Overview

	1988	1990	1992
MFHBMA	41	45	36
MFHBVF	75	81	71
MMH/MA	4.90	4.67	4.93
MMH/FH	0.1182	0.1089	0.1366
R&R/FH	0.0066	0.0055	0.0065
CANN/FH	0.0011	0.0007	0.0009

Data from NALDA system

Obsolescence Impact

Number Microcircuits	Acceptable Now / 10 yrs		Vulnerable Now / 10 yrs		Obsolete Now / 10 yrs	
280	20%	0%	35%	20%	45%	80%

Primary technology TTL

Degrading technology PMOS

OPERATION AND SUPPORT COSTS (Constant FY 94$, Thousands, 10 Year O&S)

		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	10-YR-Total	Per Month
3.0	OPERATING AND SUPPORT	$6,283	$5,177	$4,570	$4,152	$3,755	$3,504	$3,231	$3,228	$3,227	$3,144	$40,270	$336
3.1	PERSONNEL	$943	$777	$686	$623	$564	$526	$485	$485	$485	$473	$6,047	$50
3.1.1	O- AND I-LEVEL REPAIR LABOR	$906	$747	$659	$599	$542	$506	$467	$467	$467	$455	$5,814	$48
3.1.2	TAD/TDY	$36	$30	$26	$24	$22	$20	$19	$19	$19	$18	$233	$2
3.2	SPARES	$5,279	$4,349	$3,841	$3,490	$3,157	$2,946	$2,718	$2,718	$2,718	$2,648	$33,863	$282
3.2.1	I-LEVEL REPAIR PARTS	$4,790	$3,946	$3,485	$3,167	$2,864	$2,673	$2,466	$2,466	$2,466	$2,403	$30,728	$256
3.2.2	CONDEMNED	$489	$403	$356	$323	$292	$273	$252	$252	$252	$245	$3,135	$26
3.3	DIRECT DEPOT MAINTENANCE	$40	$33	$29	$26	$24	$22	$21	$21	$21	$20	$256	$2
3.3.1	REPAIR MAT'L AND LABOR	$39	$32	$28	$26	$23	$22	$20	$20	$20	$19	$248	$2
3.3.2	TRANSPORTATION	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$9	$0
3.4	TRAINING	$22	$18	$15	$13	$11	$9	$7	$3	$3	$3	$104	$0

O and S estimate does not include software support, test equipment support, or data upgrade costs due to lack of information available.

GFE PROCUREMENTS (AIR-114 OUTSTANDING)

SIN	Admin	Nomenclature	Contract	Contractor	Delivery Required	Delivery Date	Quantity
21-1229	94	MT-4609/ARC-159(V) MOUNTING BASE	N001923370200		5/1/94	2/28/93	12

ASO INFORMATION (SNAPSHOT DATABASE)

Nomenclature	NIIN	Unit Price	Manufacturer	Source of Supply	Quarterly Demand	Replacement Price	Wearout	Survival Rate
AN/ARC159( )(V)( )								
AN/ARC159/159(V)-1	001401775	$16,020			19.93	$13,737	0.01	0.99
AN/ARC159/159(V)-1	010184240	$14,790		ASO	5.95	$8,354	0.01	0.99
AN/ARC159/159(V)-1	010206384	$15,420		ASO	3.70	$21,945	0.01	0.99
AN/ARC159/159(V)-1	001007931	$12,850		ASO	5.09	$11,014	0.01	0.99
AN/ARC159/159(V)-1	001401776	$11,740		ASO	1.45	$23,235	0.02	0.99
C10436( ) ARC159(V)								
C9451/ARC159( )(V)( )								
C9577( )/ARC159(V)								
C9815/ARC159( )(V)( )	010213503	$2,780		ASO	2.26	$2,492	0.01	0.99
C9816/ARC159 ( )								
C9946( )/ARC159(V)	010184237	$4,700		ASO	1.87	$1,857	0.01	0.99
C9946( )/ARC159(V)	012225180	$4,700			0.31	$2,700	0.16	0.85
C9951( )/ARC159(V)								
C9952( )/ARC159(V)								
C9960/ARC159(V)								
CV3328/ARC159(V)								
ID1972/ARC159(V)	001401785	$1,500		ASO	1.36	$2,500	0.01	0.99
ID1984/ARC159(V)								
ID2053/ARC159( )								
RT1150/ARC159(V)	010184240	$14,790		ASO	5.95	$8,354	0.01	0.99
RT1150/ARC159(V)	012033480	$29,530		ASO	29.20	$23,210	0.05	0.99
RT1150/ARC159(V)	010206384	$15,420		ASO	3.70	$21,945	0.01	0.99
RT1151/ARC159(V)								
RT1194/ARC159( )(V)	010206384	$15,420			3.70	$21,945	0.01	0.99
SA2078/ARC159(V)	001401775	$16,020			19.93	$13,737	0.01	0.99

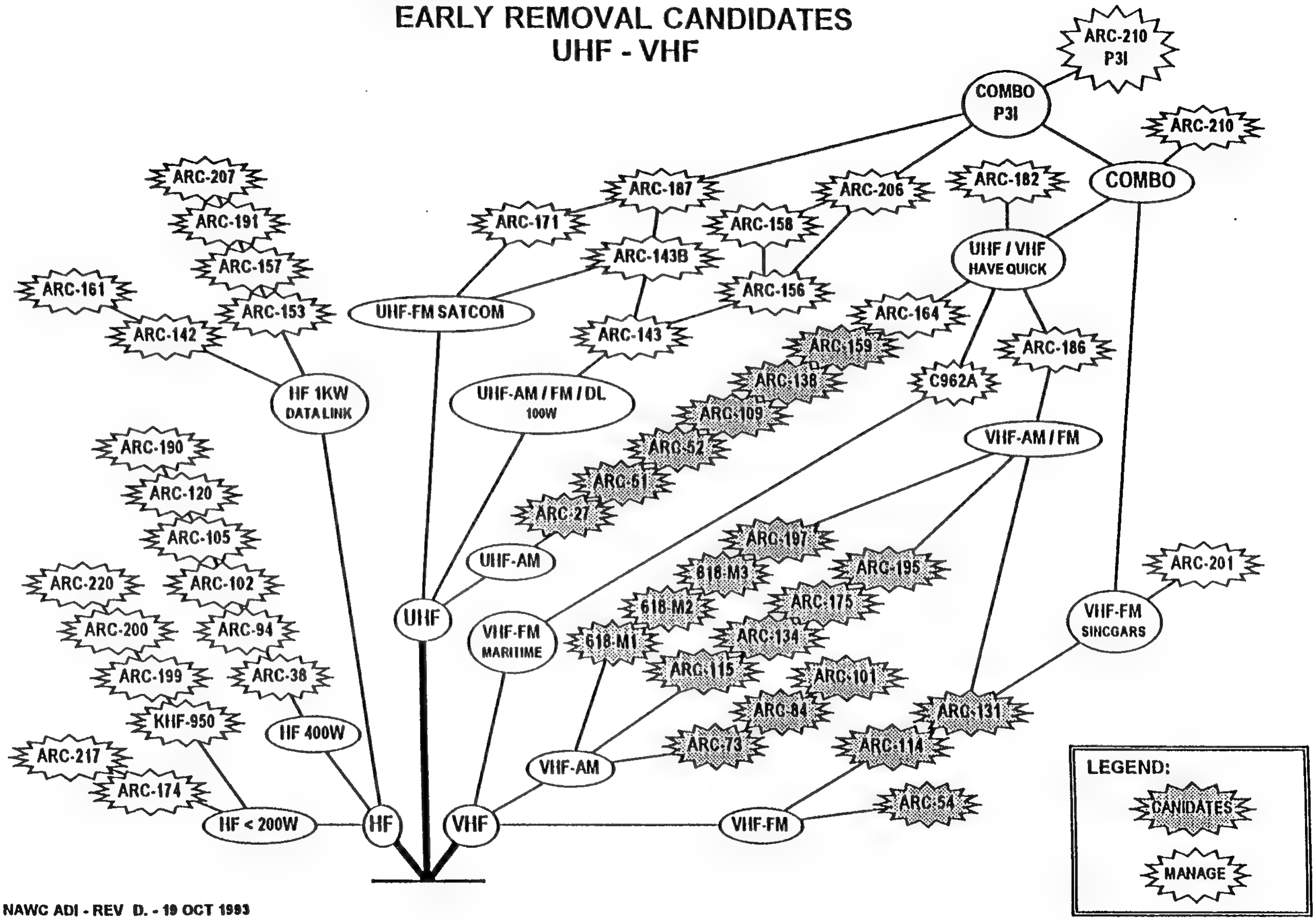
PECULIAR SUPPORT EQUIPMENT

Designator	Name
TS-3634/ARM	SWITCHING STATION TEST SET

TECHNICAL PUBLICATIONS

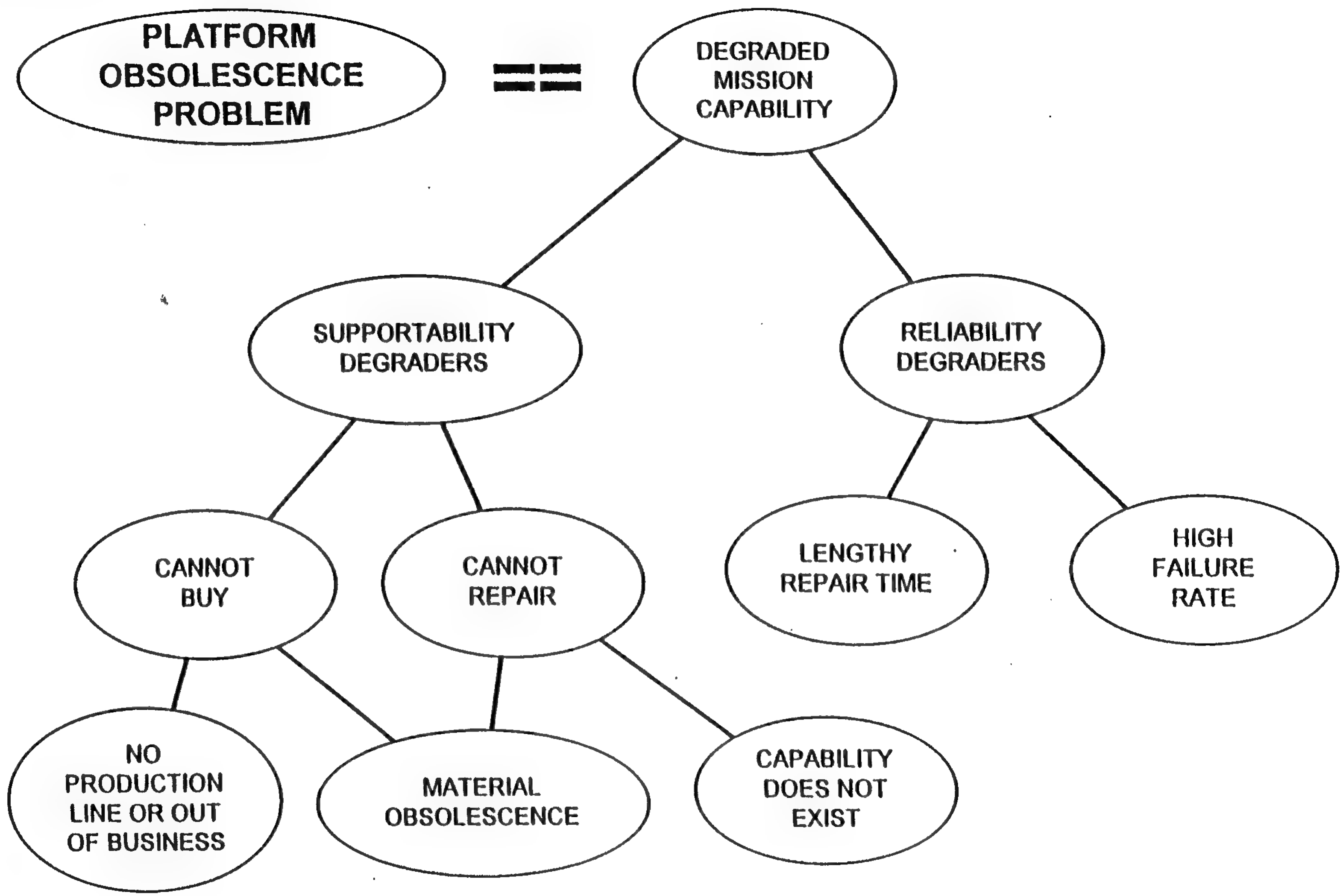
NAVAIR 16-30ARC159-1
NAVAIR 16-30ARC159-3
NAVAIR 16-35C9577-1
NAVAIR 16-35F1420-1
NAVAIR 16-35ID1984-1
NAVAIR 16-35RT1150-1
NAVAIR 16-30ARC159-2
NAVAIR 16-30ARC159-4
NAVAIR 16-35C9952-1
NAVAIR 16-35ID1972-1
NAVAIR 16-35MT4660-1
NAVAIR 16-35RT4795-1

COMMUNICATIONS RADIO TREE
EARLY REMOVAL CANDIDATES
UHF - VHF

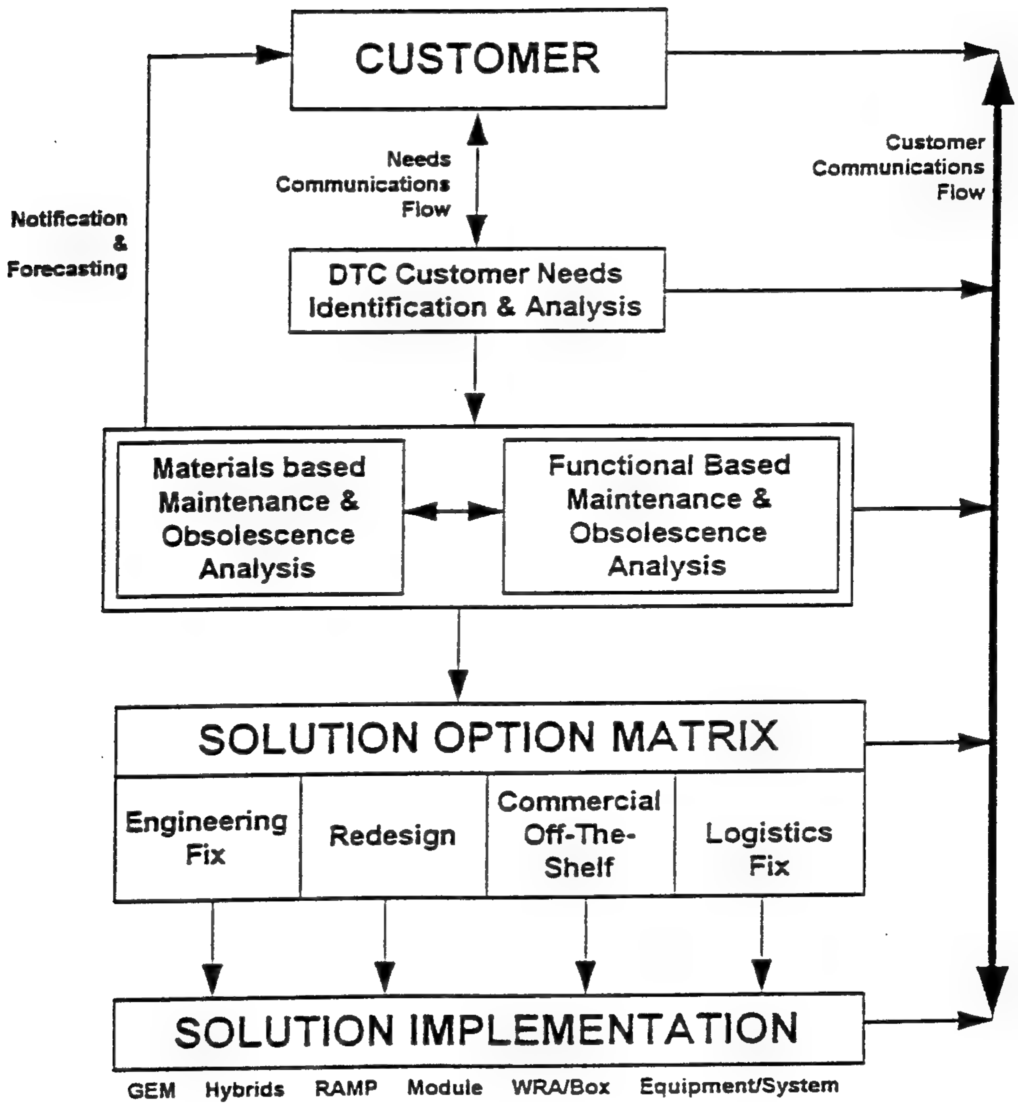


NAWC ADI - REV D. - 19 OCT 1993

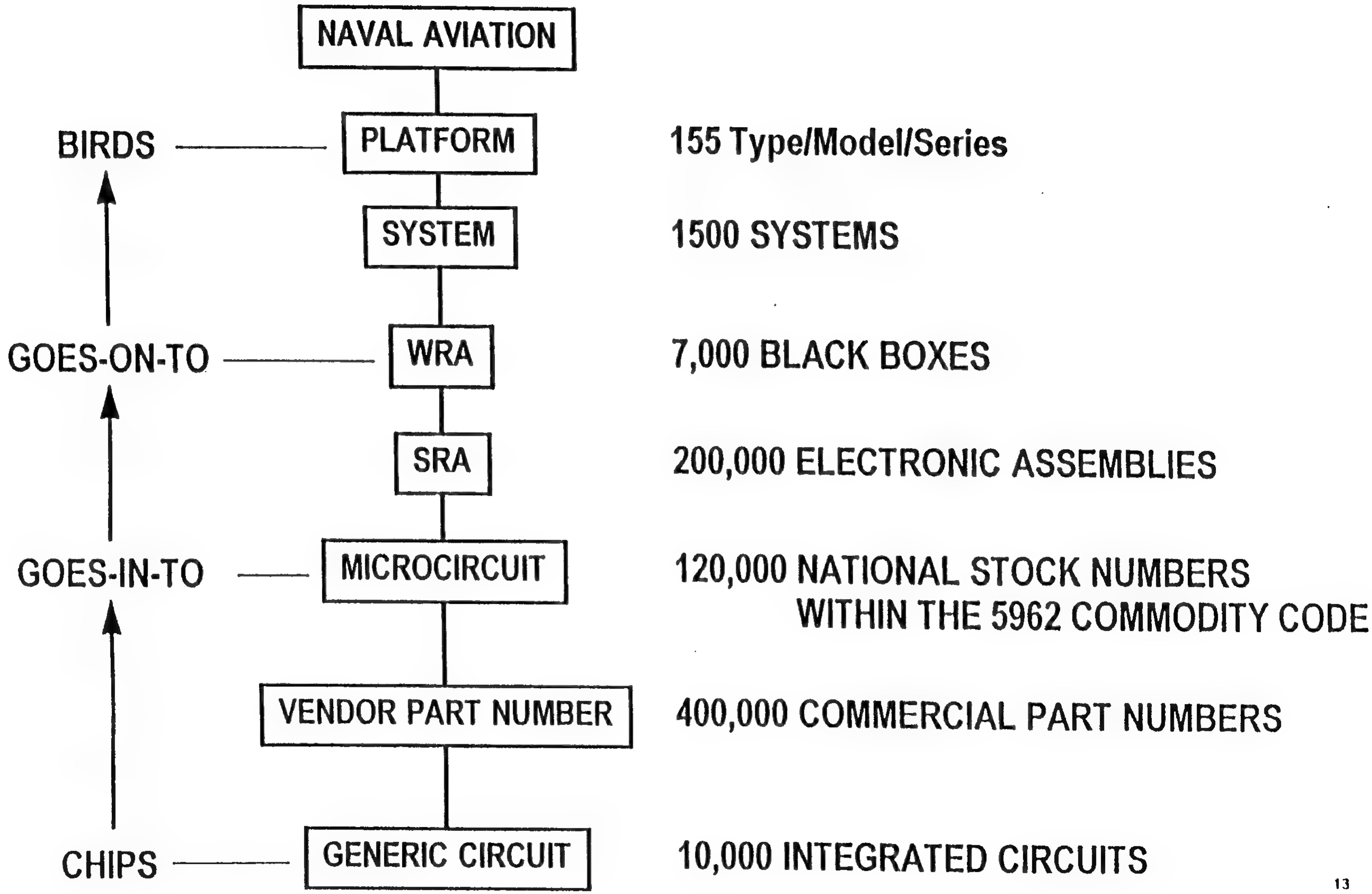
PLATFORM OBSOLESCENCE DEGRADATION TREE



DTC ENTERPRISE PROCESS



TECHNOLOGY MANAGEMENT - NAVAL AVIATION EXAMPLE
"FEEDING CHIPS TO THE BIRDS"



2.1.12 Dun & Bradstreet, Parsippany, NJ

SITE VISIT REPORT

CATEGORY	:	Commercial Data Supplier
COMPANY/COMMAND	:	Dun & Bradstreet, Parsippany, NJ
POINTS OF CONTACT	:	Susan Garavaglia, (201) 605-6216
DATE	:	11/22/94

This meeting was held over a phone conversation with Ms. Garavaglia. I asked her for a couple of example reports and literature as to how the reports and scoring was accomplished. I have attached to this Site Visit Report a copy of all materials sent to me by Ms. Garavaglia.

Dun & Bradstreet has developed a "Financial Stress Score" for over 600,000 companies. This scoring system predicts the probability that the company will face financial stress in the next 18 months. Attached to this site visit report is an explanation of how the scoring is achieved titled "Understanding Dun & Bradstreet's Financial Stress Report." Please refer to this document for a detailed explanation regarding how a financial stress score is achieved.

The Dun & Bradstreet Financial Stress Score could provide a DMSMS predictive tool with early warnings of supplier business failures. The company DUNS number could be easily crossed referenced to a FSCM or CAGE code number. Once this cross is achieved it is a simple matter to monitor the changing financial stress scores on a company by company basis. An increase in a financial stress score that crossed a predetermined threshold would signal an alarm within the DMSMS predictive tool system. The user would then be able to pull up detailed information regarding the company from both commercial and government databases in order to determine the severity of the financial stress and its impact upon supplied parts. The user would also be able to pull up a list of parts supplied by that manufacturer ranked by the most critical supply factors.

The company and score information is available for approximately $3 per record. The complete report is available for around $30 per record. Historical scores are also available for the same price.

Although the Dun & Bradstreet data is of great value, there are some items of concern when placed within the DMSMS tool that must be recognized up front. First, the data is gathered at a public reporting level, not at a

facility by facility or division by division level. Thus if a critical part is made by a small facility within a huge corporation, the loss of that facility may never be reflected within the Dun & Bradstreet data. Second, a company that ceases business without leaving any financial problems in its wake is not scored. The loss of this business would be reflected with a score of 0 in a scale of 1 to 5. Third, the data is gathered from publicly available sources. If the company is privately owned, the data will be based on what information is available and not on actual company financials. And last, as with all statistical calculations there will always be exceptions to the rule. For example, companies with great financial stress that continue to produce for years and others with no foreseeable financial stress that suddenly cease operations.

The Dun & Bradstreet Financial Stress Score and detailed financial data will provide one more automated safety net of information for the DMSMS predictive tool. It is apparent that multiple sources of periodically updated information will be required such that the DMSMS tool will have the greatest probability of correctly predicting DMSMS problems.

Attached to the end of this Site Visit report are two actual examples of Dun & Bradstreet's Financial Stress Report. The identifying company information has been removed since this report is to have unrestricted public access. The first report is for a small DoD contractor in Texas and the second report is for a very large DoD contractor located on the West Coast.

Understanding Dun & Bradstreet's

Financial Stress Report

- What The Financial Stress Score Indicates
- How The Financial Stress Score Is Calculated
- Relationship Between Financial Stress Score, Incidence of Financial Stress, and Industry Averages
- How To Read The Financial Stress Report

Dun & Bradstreet
Information Services, N.A.

Analytical Services Department

Updated Version November 1994

Understanding Dun & Bradstreet's Financial Stress Report

Dun & Bradstreet's Financial Stress Report uses statistical probabilities to classify public and private companies into one of five business classifications and a percentile ranking. The classification is based on the chance of a business experiencing financial stress within an 18 month period. This report combines the power of industry specific statistical models with the real-time delivery of Dun & Bradstreet information through DunsLink/PC.

The following industry specific models are available:

2 Digit SIC Group	Industries Covered
01, 02, 03, 07, 08, 09, 10, 12, 13, 14	Agriculture, Forestry, Fishing, Mining, Oil & Gas (The "Natural Resources" Model)
15,16,17	Construction
20 - 39	Manufacturing
40, 41, 42, 44, 45, 46, 47, 48, 49	Transportation, Communications, Utilities, Non-gas Pipelines (The "Infrastructure" Model)
42	Trucking and Warehousing
50 -51	Wholesale
52, 53, 54, 55, 57, 59	General Retail
56	Retail Apparel
65	Real Estate
58, 70, 78, 79, 84	Entertainment and Leisure
72, 75, 76, 82, 83, 86, 89	Personal and Consumer Services
73, 81, 87	Business, Legal, and Engineering Services
80	Health Care Services

The above models require financial information, either from Dun & Bradstreet's database or entered at the time of inquiry, for a Financial Stress Score to be calculated. Dun & Bradstreet has also developed a model that does not require financial information, the Non-Financial Model, to be used for those companies for which financial information is not available.

There are some industries and SIC codes that do not lend themselves to scoring through this type of model. These industries are listed below:

2 Digit SIC Group	Industry
43	**United States Postal Service**
60, 61, 62, 64, 67	**Banks, Credit Institutions, Security Brokers, Insurance, Miscellaneous Investment Institutions**
90-98	**Public Administration, Government Offices**
88	**Private Households**

What the Financial Stress Score Indicates

The Financial Stress Score represents the output of industry specific financial stress models. These models are based upon the observed characteristics of thousands of businesses in Dun & Bradstreet's database and the relationship these characteristics have to the probability of a company experiencing financial stress over a period of 18 months.

Dun & Bradstreet defines a financially stressed company as one that:

- Ceased operations following assignment or bankruptcy
- Ceased operations with loss to creditors
- Voluntarily withdrew from business operation leaving unpaid obligations
- In receivership, reorganization, or has made an arrangement for the benefit of creditors.

Voluntary discontinuances involving no loss to creditors are not defined as financially stressed.

The Financial Stress models assign a score from one to five, where a one (1) represents businesses that have the lowest probability of financial stress, and a five (5) represents businesses with the highest probability of financial stress. Financial Stress scores are not calculated for those businesses designated as "Discontinued At This Location" or "Debtor In Possession." These records are assigned a score of zero (0).

How the Financial Stress Score is Calculated

The 13 industry specific Financial Stress models and the Non-Financial model were developed using state of the art statistical and modeling techniques to select and weight the data elements that are most predictive of financial stress. The resulting Financial Stress models are mathematical equations that consist of a series of variables and coefficients (weights) that have been calculated for each variable.

The selection of the variables and the calculation of corresponding weights for each model are the result of extensive data analysis of the following Dun & Bradstreet information:

- Over 180,000 "good," or non-financially stressed, companies with financial statements in the Dun & Bradstreet database.
- Approximately 25,000 "bad," or financially stressed, companies in the Dun & Bradstreet database.
- Financial ratios, which include liquidity ratios, efficiency ratios, and profitability ratios.
- Non-financial information such as payment performance, line of business, and public records (suits, liens, or judgments)

Dun & Bradstreet analyzed the financial and non-financial information and identified the data elements which are statistically the most significant factors for predicting financial stress. The analysis showed that the simultaneous use of both financial and non-financial data produced the most powerful predictor of financial stress.

Although each industry model is unique, overall between eight (8) and twenty one (21) data elements are used in each model. For example, the Retail Apparel model relies on 17 data elements made up of financial ratios, balance sheet data, payment information, and public filing information.

The Financial Stress Models require the most current fiscal financial information, as well as non-financial data, to produce a score. Approximately 600,000 companies (public and private) within the Dun & Bradstreet database can be scored using Dun & Bradstreet's financial and non-financial data. However, about 5 million companies can be scored if financial information is provided as input or if the non-financial model is used when no valid financial statement is available.

Relationship between Financial Stress Score, Incidence of Financial Stress, and Industry Averages

The one (1) to five (5) Financial Stress Score is created by:

- Calculating the estimated probability of a company experiencing financial stress
- Ranking the firm relative to the average incidence of financial stress within the scoreable universe.

The distribution of Financial Stress Scores is not a normal distribution (bell-shaped curve) because most of the financially stressed companies are captured in the lower percentiles. For example, 38.2% of all financially stressed companies are captured by a Financial Stress Score of five (5). The distribution of scores within the Dun & Bradstreet database is as follows:

Financial Stress Score Classifications	Percentage of D&B Database
1	50%
2	30%
3	10%
4	5%
5	5%

Each financial stress score classification has an incidence of financial stress that is compared with the national average of financial stress. For example, the average incidence of financial stress nationally is 0.7%. Companies with characteristics similar to companies classified as a four (4) in the construction industry, for example, have an incidence of financial stress that is 2.14%, or 206% higher than the national average.

Table One on the next page illustrates the overall incidence of financial stress nationally and by industry group. Table Two shows, for each industry, the incidence of financial stress for each Financial Stress Score classification compared to the national average.

Pages 5 thru 9 have been removed for brevity.

For a complete copy of this document please contact:

Ms. Garavaglia (201) 605-6216
Dun & Bradstreet

How To Read Dun & Bradstreet's Financial Stress Report

Dun & Bradstreet's Financial Stress Report is divided into three sections for ease of use:

- **Summary and Identification Section**
- **Financial Stress Score Section**
- **Scoring Factors Section**

The Summary and Identification Section provides background information on the company as well as valuable information summarizing its operations. Following is a list of the key information included in this section:

D-U-N-S® Number:	Dun & Bradstreet's unique 9-digit identification number
Date Scored:	Date that the case was scored
Business Record Date:	Date of the most recent file update
Endorsement:	Name of user
Company:	Name of the company being scored, including tradestyle if available
Address/City/State/ZIP:	Physical Address of Company
Telephone Number:	Main Telephone Number
SIC Codes:	Four-digit Standard Industrial Classification Codes (up to six listed)
Line of Business:	Description of lines of business (up to six listed)
Financial Stress Score:	Financial Stress Score as calculated by the model
Rating:	Dun & Bradstreet's Composite Credit Appraisal Rating
Employees:	Total number of employees
Control:	Year the present management or owner assumed control of the business.

The **Financial Stress Score Section** contains the Financial Stress Score. It also defines financial stress and describes how the Financial Stress Score was calculated. It includes the average incidence of Financial Stress for all businesses in the Dun & Bradstreet database as well as the industry average.

A table that provides the incidence of financial stress associated with each of the five Financial Stress Score classifications is also included in this section.

The **Scoring Factors Section** lists specific factors about the company that affected the Financial Stress Score. The commentary included in this section is helpful in understanding a company's score and can be used to alert the user to other information that is available for making a decision.

A complete list of the **Financial Commentary** and **Business Commentary** is included in the Appendix.

DUN & BRADSTREET FINANCIAL STRESS REPORT

DUNS#: [redacted]
Business Record Date: Nov 29, 1993

Date Scored: Nov 22, 1994
Endorsement: MIKE SUCHANEK

Company : [redacted]

Address : [redacted]
FORT WORTH, TX 76112

Phone : [redacted]

SIC Number(s): 37-28

NET WORTH: 0
RATING: --
EMPLOYS: 100
CONTROL: 1968

Line of Business: MFG AIRCRAFT PARTS

FINANCIAL STRESS SCORE SECTION

INCIDENCE OF FINANCIAL STRESS:

Based on historical data in Dun & Bradstreet's files, the incidence of financial stress is:

National Average Incidence: 0.7%
Manufacturing industry segment: 0.8%

INCIDENCE OF FINANCIAL STRESS BY SCORE CLASS

The Financial Stress Score class for this business is FS1. The Financial Stress Score indicates that this business shares some of the same business and financial factors of businesses within the FS1 classification. The Financial Stress Score does not indicate the business will actually experience financial stress.

The table below provides the incidence of financial stress for each Financial Stress Score within the Manufacturing industry segment.

Financial Stress Score	% of D&B Files Represented	Incidence Relative to Industry Average		Incidence Relative to National Average	
FS1	50%	85 %	Lower	80 %	Lower
FS2	30%	45 %	Lower	33 %	Lower
FS3	10%	22 %	Higher	48 %	Higher
FS4	5%	98 %	Higher	170%	Higher
FS5	5%	498 %	Higher	620%	Higher

UNIVERSE PERCENTILE RANKING

Within the universe of scorable companies in the Dun & Bradstreet database,

this business falls in the 89th percentile which means that it ranks better than 88% of the businesses in this universe.

INDUSTRY PEER RANKING

Financial Stress Report

Within the universe of scorable companies in the Manufacturing industry segment, this business falls in the 93rd percentile which means that it ranks better than 92% of the businesses in this segment.

NOTE:

The Financial Stress Scores for this business were derived using D&B's Financial Stress Model for companies for which no full fiscal financial statements are available. The Financial Stress Models use statistical probabilities to classify businesses into one of five classifications and percentile rankings. The classifications are based on the likelihood of a business experiencing financial stress within an eighteen month period.

Businesses experiencing financial stress are those that cease doing business without paying all creditors in full, or reorganize or obtain relief from creditors under state or federal law.

Each financial stress score classification has an incidence of financial stress associated with it that is compared to both the industry specific model and the national average for all companies. The Universe Percentile reflects the relative ranking of a company among all the scorable companies. The Industry Peer Score reflects the relative ranking of a company among all the scorable companies in its own industry group.

COMMENTARY SECTION

KEY BUSINESS COMMENTARY:

- Payment information indicate slow payments present.

KEY FINANCIAL COMMENTARY:

No Commentary

EXPLANATORY:

- Absence of Capital and Credit Rating - The information available to Dun & Bradstreet, or the lack of available information, does not permit classification within the Dun & Bradstreet Rating System resulting in the use of alternate symbols.
- Indications of slowness can be the result of disputes over merchandise, skipped invoices, etc.

DUN & BRADSTREET FINANCIAL STRESS REPORT

DUNS#: [redacted]
Business Record Date: Jan 11, 1994

Date Scored: Nov 22, 1994
Endorsement: MIKE SUCHANEK

Company : [redacted]
Address : [redacted]
SEAL BEACH, CA 90740
Phone : [redacted]

SIC Number(s): 38-12 37-21 37-61 37-64 37-14 35-55

Financial Statement Date: Sep 30, 1993

NET WORTH: 2,374,500,000
RATING: 5A2
EMPLOYS: 77,028
CONTROL: 1928

Line of Business: MFG ELECTRONIC AIRCRAFT CONTROLS & DEFENSE SYSTEMS, AIRCRAFT, SPACE VEHICLES & ENGINES, VEHICLE PARTS & PRINTING PRESSES

FINANCIAL STRESS SCORE SECTION

INCIDENCE OF FINANCIAL STRESS:

Based on historical data in Dun & Bradstreet's files, the incidence of financial stress is:
National Average Incidence: 0.7%
Manufacturing industry segment: 0.8%

INCIDENCE OF FINANCIAL STRESS BY SCORE CLASS

The Financial Stress Score class for this business is FS3. The Financial Stress Score indicates that this business shares some of the same business and financial factors of businesses within the FS3 classification. The Financial Stress Score does not indicate the business will actually experience financial stress.

The table below provides the incidence of financial stress for each Financial Stress Score within the Manufacturing industry segment.

Financial Stress Score	% of D&B Files Represented	Incidence Relative to Industry Average		Incidence Relative to National Average	
FS1	50%	85 %	Lower	80 %	Lower
FS2	30%	45 %	Lower	33 %	Lower
FS3	10%	22 %	Higher	48 %	Higher
FS4	5%	98 %	Higher	170%	Higher
FS5	5%	498 %	Higher	620%	Higher

UNIVERSE PERCENTILE RANKING

Within the universe of scorable companies in the Dun & Bradstreet database, this business falls in the 21st percentile which means that it ranks better than 20% of the businesses in this universe.

INDUSTRY PEER RANKING

Within the universe of scorable companies in the Manufacturing industry segment, this business falls in the 27th percentile which means that it ranks better than 26% of the businesses in this segment.

NOTE:

The Financial Stress Scores for this business were derived using D&B's Financial Stress Model for the Manufacturing industry segment. The Financial Stress Models use statistical probabilities to classify businesses into one of five classifications and percentile rankings. The classifications are based on the likelihood of a business experiencing financial stress within an eighteen month period.

Businesses experiencing financial stress are those that cease doing business without paying all creditors in full, or reorganize or obtain relief from creditors under state or federal law.

Each financial stress score classification has an incidence of financial stress associated with it that is compared to both the industry specific model and the national average for all companies. The Universe Percentile reflects the relative ranking of a company among all the scorable companies. The Industry Peer Score reflects the relative ranking of a company among all the scorable companies in its own industry group.

COMMENTARY SECTION

KEY BUSINESS COMMENTARY:

- Payment information indicate slow payments present.
- Indication of open suit(s) [X], lien(s) [X], judgment(s) [X] in D&B files.

KEY FINANCIAL COMMENTARY:

- Accounts Payables to Sales Ratio is in the Upper Quartile for this Industry.
- Quick Ratio is between the Median and Lower Quartiles for this Industry.
- Return on Assets is in the Lower Quartile for this Industry.

EXPLANATORY:

- Indications of slowness can be the result of disputes over merchandise, skipped invoices, etc.
- The public record items reported may have been paid, terminated, vacated or released prior to the date this data is transmitted.

2.1.13 Environmental Regulatory Agencies, Military Specifications & Standards

SITE VISIT REPORT

CATEGORY	:	DoD Agency
COMPANY/COMMAND	:	Environmental Regulatory Agencies, Military Specs. and Standards
POINTS OF CONTACT	:	Listed below.
DATE	:	12/1/94

This report documents the research done by David Troutt into environmental regulations, the effect those regulations have on military specifications and standards, and how to obtain data on these topics.

Environmental regulations have a direct impact on the availability of many chemicals and materials. As the regulations change, so does the availability of technologies, processes and parts to military programs. For example, when CFC's where found to be an Ozone depleting group of chemicals, they were phased out and then banned through environmental regulations. These chemicals are crucial in many processes and weapon systems for cooling and cleaning. The military had to purchase a life-time-supply of the chemicals in hopes of providing enough time for the military to retool to new processes and materials. Environmental regulations are the number one cause for discontinuance for non-electronic components.

There is no single source of information regarding what materials are regulated and how they are regulated. In fact, even within the EPA itself, there is no central compilation of the regulations. The EPA is made up of several independent groups organized around the various pieces of legislation that have been enacted. These groups include Water, Air, and Ground pollutant offices. All new regulations are printed within the National Registry. The National Registry is a very large, and cumbersome text based printing process that does not lend itself to easy, automated searching. The Registry is available through commercial organizations on CD ROM, but this means of distribution again is limited to key word searches and is NOT applicable to a database oriented environment.

Beyond the EPA, there are at least 14 other organizations that in some way regulated materials at a Federal level, see attached list and example of California's List of Lists. And then added to this list is all of the State's

counter part agencies. Recently, counties and municipalities have also begun regulating materials. Compiling and tracking all of these regulations is not currently being done in an electronic database format or even in a paper based format.

Some data is available from various industrial trade organizations such as the Chemical Manufacturers Association. This data is however sporadic in nature. Usually found in articles in trade publications and white papers.

Tying the changing regulations to their impact on Military Specs and Standards is also difficult. The U.S. Military like the EPA has no centralized source for this type of information. Various branch organizations are "doing there own thing" when it comes to updating and modifying regulations that call for the use of environmentally regulated materials. The DODISS (DoD index of Specifications and Standards does provide an entry point into this web of information in that it is a centralized index of Specifications and Standards but it does not contain any information regarding the contents of the standard, such as the materials or chemicals called for.

The mandate by congress that Ozone Depleting Substances (ODS) be removed from military specifications has required the review of many regulations and some of this data is being put into a database format. Eric Rasmussan and Pat Doyel at the Naval Air Warfare Center, Lakehurst New Jersey are working on the ODS program and compiling a database of specifications and standards that call for Ozone depleting substances. Mr. Rasmussan can be contacted at (908) 323-7481. This database is a small part of a much larger needed solution in that it focuses only on Ozone depleting substances.

A second broader effort is underway at the Chief of Naval Operations offices. Tammy Schirf who can be reached at (703) 602-4497, is heading up an effort to track down the usage of over 600 hazardous materials as listed in the EPCRKA (Emergency Plan and Community Right to Know Act) act. This effort is in response to Executive Order 12856, dated August 3, 1993, titled the "Pollution Prevention Order." All of the Military Specifications and Standards listed in the DODISS have been scanned into a full text database by the U.S. Air Force. The Air Force has then expanded upon the list of 600+ substances by adding their synonyms and trade names. This list will be automatically checked against all of the Specifications and Standards. Any 'hits' will be noted for a subsequent manual review of the documents. Since some specifications are performance related and do not directly call out hazardous materials, but imply their use, a parallel effort is taking place

using the HMIS (Hazardous Material Inventory Systems). This system tracks MSDS (Material Safety Data Sheets) that accompany anything purchased by the Navy. Cross referencing the MSDS's and the performance specifications is the next step. Ultimately it should be possible cross reference NSN's (National Stock Numbers) to the regulated materials they contain.

This effort at the Chief of Naval Operations is just getting underway, but will be an invaluable source of information for an Obsolescence prediction model by providing the cross reference data between specifications and hazardous materials.

A second element of the obsolescence predictive system that needs to be created is a database that compiles all of the Environmental regulations. EPA and other agencies would need to participate by providing changing regulatory policies and key word indexes in an electronic form. As changes take place to this database, their impact can be automatically checked against the military regulations within the database discussed previously. Notifications of banned substances and regulatory compliance dates would be fed through this database providing projected dates of potential obsolescence problems.

By tying these two databases together with a database that cross references part numbers to the specifications and standards called out by those numbers, it will be possible to pinpoint exactly where a regulatory change impacts a weapon's platform.

This type of automation should help to increase the coordination amongst the branches as well as with various environmental regulatory agencies and DoD contractors.

2.1.14 GIDEP, Crystal City, Arlington, VA

SITE VISIT REPORT

CATEGORY	:	DoD Agency
COMPANY/COMMAND	:	GIDEP, Crystal City, Arlington, VA
POINTS OF CONTACT	:	Captain Smiley, Program Manager, Sandra Kraft, Deputy Program Manager, (703) 602-2364

This interview was conducted mainly with Sandra Kraft, but Captain Smiley did attend towards the end of the meeting.

GIDEP is set to play a key role in being the, "Standard data plane for the exchange of information," as stated by Captain Smiley. GIDEP's placement outside of any of the armed services provides a neutral venue for the interchange of information amongst the services. GIDEP's recent move to state-of-the-art computing architectures positions it well for the next 5 to 7 years as an information service organization.

This new equipment will provide quick access to vast amounts of information including a new database that will house DMS cases, both solved and in the process of being solved. This database will provide a means by which organizations can post DMS problems and then work together to solve them. Once a DMS case is resolved the information is maintained on the system for future reference. This system will also provide an opportunity for organizations who specialize in the solving of DMS problems to collaborate with potential "customers". Ultimately statistical data will be available for governmental organizations that will give insight into the DMS problem and trends of solution paths. DMS case information may provide another resource for measuring the accuracy of a predictive tool.

The GIDEP system should be explored further as a possible means to tie multiple data resources together into a cohesive unit. Namely, parts usage and requirements data.

Captain Smiley suggested looking at NALCOMIS, a parts tracking system used for aircraft, the tracking system used by NWAC for missile part tracking, and the MRMS used by Naval Sea Systems for parts tracking be investigated as to their potential use within a DMS tracking system. These data resources will be explored in future interviews.

GIDEP's inclusion of DMS case information on a DoD and Government Agency wide basis will provide an important part of DMS solution tool set.

2.1.15 IASO (Industrial Analysis Support Office), Philadelphia, PA

SITE VISIT REPORT

CATEGORY	:	DoD Agency
COMPANY/COMMAND	:	IASO, Industrial Analysis Support Office, Philadelphia, PA
POINTS OF CONTACT	:	Nathaniel Green, (215) 737-3454
DATE	:	10/14/94

This meeting was held at IASO (Industrial Analysis Support Office, Philadelphia Pennsylvania. The meeting was attended by William Ennis who heads up the Industrial Base Assessment group, Nathanial Green, as well as other IASO staff members.

IASO provides detailed research and analysis on the industrial manufacturing base. Their focus is on potential DMSMS issues as they would effect the U.S. Military. Their 'mission' is "Develop an internal DoD capability to continually assess and understand the effects of the Federal budget on the defense industrial base."

IASO is 'hired' by other DoD agencies to analyze the available support from manufacturers. Research has been done in a wide variety of equipment and product categories including electronics, plastics, engines and ammunition.

Customers have shaped the areas researched to date. Mr. Green estimates that there are over 3 million cage code numbers (registered manufacturers doing business with the DoD. This vast number by definition requires a focused effort aimed at only those production sectors that are having critical DMSMS problems.

IASO's database of suppliers they have obtained information from is over 2,000 with another 3,000 to be added this year. The data collected on manufacturers is through a standardized form DD 2650. A copy of the DD 2650 form is attached to this report.

The information from the DD 2650 form is entered into a relational database where it can be tabulated and easily retrieved in the future. The costs of gathering the data is minimized by utilizing DLA/DPRO/IAS Officers that are geographically located near the plants and facilities. The quality of the data is highly dependent upon the IAS Officer, their relationship with the contractor's management, and the cooperative spirit of the

manufacturer. The overall quality of the data is hard to judge based upon a quick review, but it is reported to be acceptable.

The data gathered through the DD 2650 includes detailed financial trends, sources of income in the form of percentages, workload distributions, trends within the staffing of the plant, changes and capabilities of the equipment within the plant, production capabilities, subcontractor network and support, and environmental regulatory concerns. All of this data would be of great interest to the buyers of products from the organization reviewed. For example, downward trends in personnel would signal a shift in business interest or a possible a lack of profitability.

IASO has developed the following criteria for assessing DMSMS risks:

RISK	CRITERIA
Low	There are several sources currently providing the requisite industrial capabilities; or There is at least one reliable source currently providing these capabilities with potential alternative qualifiable sources available if necessary.
Moderate	There is only one reliable source currently providing the requisite industrial capabilities. There are no alternative, qualifiable sources available within acceptable time and cost parameters.
High	There is one participating source, but one that lacks the requisite industrial capabilities, is unable to develop the requisite capabilities, and/or is not financially viable; or There is no active, reliable source; and There are no potential alternative, qualifiable sources available within the acceptable time and cost parameters.

The above criteria is a definition for DMSMS in that it lays out the ground rules for what makes an item a DMSMS problem.

IASO's data gathering and reporting ability would be a great asset to a DMSMS predictive tool by feeding early

warning data in the form of company trends into the DMSMS model. IASO could also be 'subcontracted' to research an industrial segment within which data from other sources is less than adequate. The more programs that utilize the data gathered by the IASO, the more the costs of obtaining that data can be distributed.

CAGE NO:

INDUSTRIAL BASE ASSESSMENT UPDATE QUESTIONNAIRE
(Stocked and Used by OASD(P&L/IEQ)

Form Approved
OMB No. 0704-0352
Expires Jun 30, 1996

Public reporting burden for this collection of information is estimated to average 1 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project *(0704-0352)*, Washington, DC 20503.

PLEASE DO NOT RETURN YOUR COMPLETED FORM TO EITHER OF THESE ADDRESSES.
SEND YOUR COMPLETED FORM TO THE APPROPRIATE COGNIZANT AO OR PRO OFFICE.

PART A - FACILITY IDENTIFICATION

1. COMPANY OR U.S. GOVERNMENT DEPARTMENT/FACILITY

a. NAME OF COMPANY OR U.S. GOVERNMENT DEPARTMENT/FACILITY

b. (1) NAME OF COMPANY POINT OF CONTACT

(3) TELEPHONE NUMBER *(Include Area Code)*

(2) TITLE

(4) FAX NUMBER *(Include Area Code)*

c. (1) NAME OF GOVERNMENT REPRESENTATIVE

(3) TELEPHONE NUMBER *(Include Area Code)*

(2) TITLE

(4) FAX NUMBER *(Include Area Code)*

d. ADDRESS OF GOVERNMENT REPRESENTATIVE *(Include ZIP Code)*

2. FOREIGN DIRECT INVESTMENT. HAS THIS PLANT OR PARENT COMPANY RECEIVED OVERTURES OF FOREIGN DIRECT INVESTMENT OVER THE LAST YEAR IN ITS OPERATION? ☐ YES ☐ NO

IF YES, EXPLAIN:

PART B - FINANCIAL

ANNUAL VALUE OF SHIPMENTS. VALUE OF SHIPMENTS IS THE CURRENT MARKET VALUE OF ALL PRODUCTS ACTUALLY SHIPPED DURING THE MOST RECENT YEAR.

YEAR	TOTAL *(IN MILLIONS)*	USA	USN	USAF	DLA	SDIO	COMMERCIAL	FOREIGN	*OTHER GOVERNMENT
	$	%	%	%	%	%	%	%	%

* OTHER GOVERNMENT *(i.e., FEMA, FAA, NASA, etc.)*

PART C - MANUFACTURING CAPACITY AND UTILIZATION

1. DOES PRESENT CONCERN EXIST AS TO POSSIBLE LOSS OR REDUCTION IN CONTRACTS/PROGRAMS THAT MAY NECESSITATE CLOSURE OF THIS PLANT? ☐ YES ☐ NO

EXPLAIN:

PART C - MANUFACTURING CAPACITY AND UTILIZATION *(Continued)*

2. INDICATE ACTUAL CAPACITY UTILIZATION. CAPACITY UTILIZATION % = CURRENT PLANT OUTPUT / MANUFACTURING CAPACITY

CURRENT ____________ %

3 CURRENT WORKLOAD DISTRIBUTION PERCENTAGES *(%)*. WORKLOAD DISTRIBUTION PERCENTAGE IS THE PERCENTAGE BREAKDOWN OF CURRENT PLANT OUTPUT THAT IS DEVOTED TO VARIOUS CUSTOMERS.

USA	USN	USAF	DLA	SDIO	COMMERCIAL	FOREIGN	OTHER GOVERNMENT*

*Other Government *(i.e., FEMA, FAA, NASA, etc.)*

4. WHAT IS THE CURRENT BACKLOG FOR THIS FACILITY?

OF MONTHS

COMMERCIAL ____________

GOVERNMENT ____________

PART D - LABOR

1. TOTAL SITE EMPLOYMENT LEVEL

2. CATEGORY	# OF PERSONNEL	PERSONNEL/SHIFT *(1)*	PERSONNEL/SHIFT *(2)*	PERSONNEL/SHIFT *(3)*	HOURS/DAY	DAYS/WEEK
a. OFFICE/SUPPORT						
b. ENGINEERING						
c. MANAGEMENT						
d. TOTAL PRODUCTION						
(1) SKILLED						
(2) NONSKILLED						

PART E - PLANT FACILITIES/EQUIPMENT

1. COMPANY MODERNIZATION IMPROVEMENT PROGRAMS

a. PERCENT OF GROSS SALES APPLIED TO FACILITY MODERNIZATION DURING THE MOST RECENT YEAR *(e.g., air conditioning, heating, facility expansion, etc.)(Not including capital equipment)*:

b. PERCENT OF GROSS SALES APPLIED TO CAPITAL EQUIPMENT UPGRADES DURING THE MOST RECENT YEAR *(e.g., hardware/software, flexible manufacturing cells, etc.)*:

PART F - PRODUCTION CAPABILITY

(NOTE: Reproduce Part F (Page 3 and Page 4 for each end item produced)

1. MANUFACTURED END ITEM		2. CONTRACT OR PURCHASE ORDER NUMBER	
3. COMPLETION DATE	4. UNIT PRICE	5. TOTAL CONTRACT QUANTITY	6. SHELF LIFE *(in years)*

7. MANUFACTURING LEAD TIME *(in months)*. Interval between date a manufacturer accepts a firm order and shipment date of first complete production unit.

GOVERNMENT REPEAT ORDER	COMMERCIAL REPEAT ORDER

DEFINITIONS

GOVERNMENT: Produced to government/military specifications.
COMMERCIAL: Produced to commercial specifications.

REPEAT ORDER: Lead time required, after a complete break in product, to produce an item identical, except for minor changes, to one made on a previous order.

8. MONTHLY PRODUCTION RATES. ACTUAL RATE:

DEFINITION

ACTUAL PRODUCTION RATES: Number of units being produced to meet current contractual requirements.

PART F - PRODUCTION CAPABILITY (*Continued*)

MANUFACTURED END ITEM:

9. SUBCONTRACTORS

a. SUPPLY DATA FOR EACH MAJOR/CRTITICAL SUBCONTRACTOR TO SUPPORT MANUFACTURED END ITEM

(1) SUBCONTRACTOR

(2) ADDRESSS/CITY/STATE/ZIP/COUNTRY

(3) POINT OF CONTACT

(4) TELEPHONE NUMBER *(Include Area Code)*

(5) DUNS NUMBER

(6) CAGE NUMBER

(7) MANUFACTURED ITEM

(8) MANUFACTURING LEAD TIME *(in months)*

(9) PROGRAM SUPPORTED

(10) PRODUCT SUPPORTED

(11) SINGLE SOURCE ☐ YES ☐ NO

IF SINGLE, LIST ALTERNATE SOURCE(S):

CITY/STATE/ZIP/COUNTRY:

(12) SOLE SOURCE ☐ YES ☐ NO

(13) FOREIGN SOURCE ☐ YES ☐ NO

IF FOREIGN SOURCED, IS THIS ITEM AVAILABLE DOMESTICALLY? ☐ YES ☐ NO

IF NOT AVAILABLE DOMESTICALLY, ESTIMATE TIME AND COST TO QUALIFY A DOMESTIC SOURCE: ________ MONTH $ ________

DEFINITIONS

SINGLE SOURCE: Only one known qualified producer of an item. However, other sources are known to have the capability to manufacture.

SOLE SOURCE: An item being purchased from one source, and no other production capability exists.

b. WHAT IS YOUR ESTIMATE AND 5/10 YEAR FORECAST OF PERCENT FOR MATERIAL COST ASSOCIATED TO END PRODUCT UNIT COST?

CURRENT ________ FIVE YEARS ________ TEN YEARS ________

c. DOES YOUR COMPANY HAVE ANY PROBLEMS OBTAINING MATERIALS OR COMPONENTS FROM THIS SUBCONTRACTOR?

d. ARE YOU CONCERNED WITH CONTINUED SUPPORT FROM THIS SUBCONTRACTOR?

e. WILL COMPLIANCE WITH ENVIRONMENTAL REQUIREMENTS IMPACT SHIPMENTS FROM THIS SUBCONTRACTOR? IF YES, IDENTIFY.

PART G - OVERALL OPINIONS

(NOTE: If additional space is required, attach separate page and identify section and question).

PLEASE PROVIDE ANY FURTHER COMMENTS THAT YOU BELIEVE ARE RELEVANT TO THE INDUSTRIAL BASE ISSUE.

COMPANY REPRESENTATIVE	DATE	GOVERNMENT REPRESENTATIVE	DATE

2.1.16 McDonnell Douglas, Corp., St. Louis, MO

SITE VISIT REPORT

CATEGORY	:	DoD Contractor
COMPANY/COMMAND	:	McDonnell Douglas, Corp., St. Louis, MO
POINTS OF CONTACT	:	Scott Amelung, Al Rose
DATE	:	9/27/94

This meeting was held at McDonnell Douglas Corporation, St. Louis, Missouri. In attendance was Albert Rose and Scott Amelung. Mr. Amelung is the Manager of Subcontract Requirements. Mr. Rose assists Mr. Amelung in coordinating DMSMS detection and resolution efforts among the F/A-18's contractors. This coordinating effort is in the form of Joint Process Teams which involve the supplier and customer.

Although electronics is seen as having the largest DMSMS problems, Mr. Amelung pointed out that the downsizing of the U.S. Military is resulting in the loss of all kinds of manufactured items. An area of great concern to Mr. Amelung is exotic materials which are not in high demand by non-military manufacturers.

Mr. Amelung suggested that databases containing information about critical items and their manufacturers would be of great help. The database should monitor the loss of sources and warn users of those items. The total loss of manufacturing capability is not being monitored today. The technology to make something is as crucial as the materials it is made of. The database should monitor who has the capability to make an item. This suggestion ties in closely the proposed database by the RAMP manager, Jason Hirsh.

The database should also track the movement offshore of manufacturing capabilities, since the purchasing of items from off-shore suppliers is prohibited without a waiver. EPA regulations and their impact on processes, chemicals, materials, and lubricants should also be a part of the database.

Mr. Amelung and Mr. Rose defined the type of tools that would assist them with F/A-18 DMSMS problems:

> The tools should identify "Endangered Items", those items that are single sourced or have a critical factor that would limit availability. This would allow for the contractor to focus DMSMS efforts to better manage resources.

The Tools should provide a means by which new designs as well as DMSMS solutions can be evaluated for potential near term DMSMS problems.

The tools should make it easy to review parts and sources of a system. The "Health" of the system would be evaluated.

The tools should be able to categorize parts to assist in planning and management of DMSMS problems.

The tools should provide early warnings and better communications to and from suppliers.

The tools should track the health of the company, industry, and materials/processes.

Mr. Amelung pointed out that it is important to look at the "Basic data" of a part, that is the materials, complexity and proprietaryness of the design in evaluating a part's susceptibility to DMSMS. A model of the above description would assist the user in picking the healthiest companies, processes, and materials.

Mr. Amelung and Mr. Rose suggested that the system be designed from the ground up with an open architecture in mind. They pointed out that there is a great deal of proprietary company data such as quality inspection reports, Purchase Order history, Purchase Order schedules, audits, etc. that should be tied into the predictive tools. This information would not be released by the contractor to the outside for fear of lawsuits from companies that may be harmed by the information. Thus the tools would contain a database of outside data such as financial and industry sources, as well as internally generated data. The key is providing an integrated environment where all of this data is easily available to the user.

Mr. Amelung also noted that as the U.S. military is moving towards NDI and away from standardization, commercial organizations such as automobile manufacturers are moving towards standardization in hope of lowering costs and increasing quality.

2.1.17 Microsemi Corporation, Costa Mesa, CA

SITE VISIT REPORT

CATEGORY	:	Component Manufacturer
COMPANY/COMMAND	:	Microsemi Corporation, Costa Mesa, CA
POINT OF CONTACT	:	Philip Frey Jr., CEO, (714) 979-8220
DATE	:	7/29/1994

Microsemi Corporation is the largest supplier of military grade discrete electronic components such as diodes and rectifiers. They do not currently produce transistors.

According to Mr. Frey, Microsemi has discontinued only one device in the 35 years it has been in business. Microsemi will supply any device that it has made in the past when requested. No life-cycling or predictive tools are used by Microsemi.

2.1.18 NASC (Naval Air Systems Command)

SITE VISIT REPORT

CATEGORY	:	DoD Agency
COMPANY/COMMAND	:	NASC (Naval Air Systems Command)
POINTS OF CONTACT	:	Janet Alberts, Bob Stillings, Program Analysts, (703) 604-6200 ext. 3453
DATE	:	9/15/94

Janet Alberts and Bob Stillings are Program Analysts specializing in the areas of DMSMS and Key Assets Protection for NAVAIR and its contractors. Ms. Alberts also heads up the Defense Priorities and Allocations program. Mr. Stillings is also involved with the Title 3 program which provides funding on a limited basis for defense critical, non-commercially supported technology development and production.

Ms. Alberts and Mr. Stillings provide coordination, analysis and recommendations for DMSMS problems within NAVAIR and its contractors. Electronics is seen as the majority of the DMSMS problem regarding the costs involved. Mechanical parts are having a larger and larger role in DMSMS but are still not as much of a focus group due to the lower solution costs. Mr. Stillings stated that the large amount of DMSMS in electronics is due to the rapid shifts in technology vs. the much slower shifts in the areas of mechanical parts.

The GIDEP database for DMSMS case history and tracking is seen as essential within the NAVAIR group for reducing the costs involved with DMSMS. Automation tools within programs are also seen as essential in order to catch the DMS problems as soon as possible at the contractor and industry level. There is some question as to whether DMS management should be a contractor responsibility or a program responsibility. The key is seen as getting the contractor involved in solving DMS problems in the early stages thus alleviating costs.

Ms. Alberts and Mr. Stillings see an increasing role within NAVAIR as a coordinator for DMS problem solution resources. As the role of program managers has changed from being only involved in the program's production years to being involved in the program's deployment and operations, there will be a growing emphasis on tracking integrated circuit component usage at all levels of a program. Prediction tools will be essential in providing program management insight into DMS priorities and problem areas.

Mr. Stillings did note that although sharing DMS solutions will have a positive impact on reducing costs, there will most likely still be diverse solutions chosen for the DMS problem due to the autonomy of each program. Thus the most cost effective solution may not be the only one implemented to solve a DMS problem. Ms. Alberts recommended that interviews be conducted with the HONA (Health of Naval Aviation) program and RAMP (Rapid Acquisition of Mechanical Parts) program to obtain their insights into DMS and the future of DMS solutions. These interviews will be conducted as part of this research project.

Ms. Alberts and Mr. Stillings are involved in the development of a guideline document titled "Defense Essential Industrial and Technological Capability Considerations." This document is currently in the Draft stage. These guidelines detail the process by which a source of supply is determined to be essential to our national defense and as such should be supported by U.S. Government funds. Part of determining if the source is essential is to attempt to locate substitutable sources as well as to determine where the supplied parts are used. Both of these needs are exactly the same as those who are solving DMSMS problems. The development of a DMSMS predictive tool would be of great value to people who are determining if a source is essential or not.

2.1.19 National Semiconductor Corporation, Santa Clara, CA

SITE VISIT REPORT

CATEGORY : Semiconductor Manufacturer
COMPANY/COMMAND : National Semiconductor Corporation, Santa Clara, CA
POINTS OF CONTACT : Brad Paulson, Jim Martin
DATE : 8/31/94

National Semiconductor is one of the largest suppliers of Military grade integrated circuits. To support the longer term needs of military programs National has developed an automated communications system that projects the availability of its own integrated circuits. This system provides four levels of categorization:

S - Sales, fully released for sales with supporting sales collateral available in all regions.

N - Not recommended for new design - Product is approaching maturity. Product may be going through a revision or into lifetime buy status.

L - Lifetime buys are being accepted.

K - Product is no longer offered for sale.

This information is available on a part-by-part basis through a dial-up, on-line information system. This data is made available to all customers.

National does not maintain life cycle models for its parts and does not have a predictive model for part obsolescence. However, National does review its product offering at a part level every six months and does revise a 5 year plan during each of these reviews.

During this review, the sales volume, on-hand die stock, process and fabrication line utilization are reviewed. Parts are categorized into one of three possibilities:

Profitable - The part is selling well and is making a profit for National.

Marginal - The sales volume of the part is low and further factors must be analyzed to determine the future production of the part.

Not Profitable - The part's sales volume is so low that future production of the part s not warranted. Marginally profitable parts require further review of many factors to determine the future of their production status. The factors include the fabrication process, the production facilities utilized to make the part, commercial equivalent part sales volume, and other production demands on those facilities.

Another factor that comes into play is that most IC manufacturing is a "batch" oriented process. Thus low volume parts purchased from a manufacturer are most likely to be coming from a die bank, not fresh from a production line. For a low volume chip, this means that a batch run may meet the supply requirements for a period of 3 to 5 years. In the mean time, production line improvements and changes take place. When the die bank runs low, an evaluation takes place as to whether it would be profitable to make more of these devices. In some rare cases production processes may no longer exist to make the device.

According to Brad Paulsen, these factors and many more do not lend themselves to automated systems. In fact, due to the monetary nature of these decisions, there is great reluctance to "let a computer decide" which part to discontinue.

National does pride itself on communicating at a part-by-part level early notification of a part approaching the end of it's production life. This information is of great value for the short term (6 months to 1 year) producibility/maintainability review of a deployed military platform. This information does allow for a short-term projection of part availability, but does not assist a long-term predictive obsolescence tool.

Attached to this report is a copy of Rick Cassidy's white paper presented at the DMS conference held in Jupiter Beach Florida, summer of 1994, titled Obsolescence from the IC Manufacturer's Viewpoint." This paper is very enlightening regarding the DMS problem and integrated circuit manufacturing.

Some key points made by Mr. Cassidy include:

An inverse relationship exists between the complexity of the part and it length of time it is available for purchase. For example, many transistors developed over twenty years ago are still available, but most static rams that were developed as little as 8 years ago are no longer available. Sophisticated parts have a tendency to have new, better, more powerful replacement parts replace them, while "glue-chip" devices remain in the market place for

much longer time periods.

The move to commercial components will NOT solve the DMS problem, but only increase it. Commercialization lends itself to less communication and less commitment from manufacturers as to a parts longevity.

Communication and commitment from the supplier is extremely important in reducing the DMS problem for a weapon system. Visibility of what is designed-in as well as communicating future production needs at a part level assists the user's of the parts and the suppliers of the parts to work as a team. Thus, as a supplier must turn its resources to more profitable items, a migration path or lifetime buy can be properly implemented. Traditional militarized part producers maintain a dedicated team that is knowledgeable as to the longer term needs of military users.

To summarize, National does not maintain long-term projections regarding a part's availability, but does closely monitor and give at least a 6 month warning as to it's discontinuance. This information is very valuable in protecting a military program from unrecognized DMS problems, those that are caught after the fact that the part is no longer available.

The problem is that many times National Semiconductor does not know who to notify since parts may be purchased through a non-direct channel such as distributors. The use of Source Control Drawings hides a part's true identity from the user of the part, also causing discontinuance alerts to go unnoticed.

Better identification of parts used, improved communication, and team work goes a long way to preventing DMS problems from going unnoticed until alternative solutions are reduced to all but the most expensive options.

Obsolescence from the IC Manufacturer's Viewpoint

Rick Cassidy
Vice President and General Manager
Military/Aerospace Division
National Semiconductor Corporation

Introduction. Obsolescence is such a bothersome thing that we keep inventing new aliases behind which we can hide it. The problem with these eupemisms is that they typically disguise both the problem and its causes. While conventional myths attribute obsolescence to the callousness of manufacturers, we are every bit as uncomfortable with the problem and its impact as are our customers. We wish it was avoidable.

The inescapable truth is that obsolescence has been an aspect of the human condition since bronze replaced stone – long before we learned to write and to record our problems for those who succeeded us. In prehistory, technology evolved slowly, so the Hittites and the Etruscans were probably unconcerned whether they had fallen behind the Greeks and the Romans. Technology today evolves at an incredible pace that has forced those of us who sell technology to be extremely concerned with how our technology compares with that of our competitors. We must remain ahead or perish.

The rapid burgeoning of technology has not, however, led to an equal increase in the resources available for its maintenance and development. IC manufacturing resources are expensive. Some countries have GNPs smaller than the cost of a state-of-the-art fabrication module. We must use our expensive resources wisely. Cold and inescapable economic realities force us to discontinue older products whose volume (and thus financial return) are no longer viable.

But we cannot ignore our responsibility to our customers: we must ensure that we accomplish our product transitions in a manner that minimizes the impact on our customers' business. We cannot do so unilaterally. We must work together. That is what I want to address today.

I will address five key areas. **First**, I want to address the term *diminishing manufacturing sources*, since I feel its inaccuracy creates hopes that will never be realized. **Second**, I want to describe in meaningful detail the process whereby obsolescence occurs, since an understanding of that process is key to the solutions we can offer. **Third**, I want to talk about what we do to minimize the impact of obsolescence. **Fourth**, I want to mention the roll of "sunset technology" firms, whose support is critical. **Fifth**, and perhaps most important, I will recommend steps that will help systems designers to minimize obsolescence problems over a system's lifetime.

DMS. I have trouble accepting the term *diminishing manufacturing sources*. We do not have a diminishing sources problem. The term DMS has fostered a perception that "if we could *only* make our business more *attractive*, those who have turned away would flock back." There are more IC manufacturers today than there were in 1980. At the aggregate level, U.S. firms have more resources and produce more products than the entire world had or produced a decade ago. Nothing has gone away.

Instead, the nature of the business has changed dramatically. In 1970, 1000 units was a large lot. 5-micron lithography, 3-inch wafers and 12 wafer runs limited production volumes. Devices with annual demand of only a few thousand a year were as profitably supported as those selling at rates of thousands per week. Today, with 6-inch wafer and sub-micron technology, a single wafer can provide a ten-year supply of a slow running device. Profits, however, accrue from volume. To remain profitable, IC makers must focus on those devices and processes which generate profitable volume. As a result, resources are constantly reallocated to new products, new technologies and new markets.

The sources of older products have not gone away. They have reacted to market pressures and reallocated their resources to what the market demands.

The Obsolescence Process. We need to understand why those resources have been reallocated. The issue has several aspects, particularly in relation to the aerospace market. The first is device demand. The industry's IC consumption curve is bimodal. When a new product is introduced, commercial sales typically begin within six months and ramp up to volume rapidly. Maxcimum demand will be achieved within a year or two, and begin to fall in a few years as newer products are designed into new models and system upgrades.

The rate at which this happens will vary with product complexity. Historic data shows an inverse relationship between product complexity and product longevity. The first semiconductors were simple devices, transistors, diodes, thyristors and the like. A surprisingly large percentage of the discrete devices introduced in the 1960s remain in production today. As ICs displaced them from the core of systems, they became the "glue chips" used to link ICs together in applications. Many early ICs also remained in production as their central roles were preempted by processors, controllers, data acquisition devices and the like. But the percentage of ICs that survived was less than that of discretes. The survival rate varied from line to line. Monolithic analog devices had high survival rates. Logic families tended to obsolete as higher performance families were developed, but most high demand circuit functions were available in each new family. Memories obsoleted rapidly. Density has always been important in all applications, and small memories were quickly replaced by large memories.

Complex functions obsolete at a surprising rate, due to some of the same considerations that impact memories. Commercial systems always seek the most performance per unit of silicon. This is best illustrated by the evolution of microprocessors: demand jumped from 8-bit to 16-bit to 32-bit almost overnight as new data widths were introduced. The first 16-bit microprocessor, introduced in 1975, was obsolete before that decade ended. Whether products were simple or complex, their disappearance or continued availability was always determined by demand.

The bimodal demand curve negatively impacts defense systems. Military applications lag the commercial curve. While they may move into *design* as rapidly as commercial applications, they cannot transition into production without first completing a qualification phase. For simple systems, such as hand held equipment, that may take two years. More complex systems (particularly those tied to the development of a new platform) can wait seven to ten years for a production release. Military demand often begins to increase about when commercial demand starts to fall. The disparity between long defense production runs and short commercial production cycles extends the military demand curve well beyond the point at which commercial demand has disappeared. The procurement streamlining that Secretary of Defense William Perry recently announced may bring the two curves closer together, but it will neither eliminate the gap nor resolve the production cycle disparity.

Commercial demand drives the allocation of wafer fabrication resources, even within the handful of firms (like National) which are fully committed to the defense market. Military ICs once represented over half the industry's sales. Today, they account for less than 4% of sales dollars, and only a fraction of 1% of the industry's unit ouput. Low unit volume forces the military side of any company to rely on commercial fabrication resources -- even when the company's military sales are sufficient to support a separate military division. When commercial demand for a device wanes (as it inevitably does), the product line must consider obsoleting the device, or it will be unable to meet corporate financial objectives. What then happens to the military product?

There are several possibilities. The first, but least likely, is that military demand will be sufficient to support continued production. In that instance, nothing happens to the military product. It continues to be readily available. In some cases, military demand may be such that we elect to build a large wafer bank to continue to support the product for several years longer than the commercial sector. Again, there is no impact at that time on military users. Keep in mind, however, that military demand will also fall over time, and the product will eventually be obsoleted.

The second scenario has little impact on military needs: there is often no military demand for a product. A large number of products are designed for specific commercial applications -- automotive, consumer electronics, telecom, and the like. They are only offered as commercial temperature plastic

products, and military designers show little interest in them (but I'll return to that issue later). When these are obsoleted, they have no impact on defense procurement.

The third possibility covers slightly under half of the products the industry offers. There is military demand, but it is not adequate to justify continued allocation of fabrication resources. These are the parts that create the problems.

Before I talk about how we deal with those devices, I must emphasize one critical aspect of the resource reallocation process whose impact is often not clearly understood. Wafer fabrication is not *product* driven; it is *process* driven. Every product an IC manufacturer designs targets design parameters that tie to a specific standard fab process. Without process standardization, the industry could not utilize high volume, computer-managed fabrication equipment. When the majority of the products produced with a given process lose their market viability, *all* products using that process must be discontinued. That often results in the termination of a product whose volume is still reasonably high. When practical, the few remaining viable products will be redesigned to the new process, but that is typically done only where high *commercial* demand exists (because of the unit volume concerns).

Announcing Obsolescence. Responsible manufacturers do everything in their power to minimize the impact of product obsolescence on *all* customers. (Semi-responsible manufacturers only worry about commercial customers). National's process is typical of what any committed manufacturer should do. The most important elements are timing and visibility. Our approach is to "prune" the product line on a scheduled rather than random basis. For military products, we publish two obsolescence lists each year. We feel that individual notices scattered throughout the year cause confusion.

We time these announcements to the publication of our price book. Each price book contains a section listing the products that have been discontinued and the date until which lifetime buys will be accepted. Our internal obsolescence policy prohibits obsolescence notifications outside the price book cycle, defines the procedures to be followed during obsolescence and establishes life-time buy windows based on the product's status. The LTB window may be as long as twelve months for products for which National is the only source.

But we don't rely exclusively on the price book for customer notification. We check our sales history file to identify known users of the product, and we notify them directly, indicating the same LTB date that will appear in the price book. In most cases, we can give known customers an advance warning by sending them notifrication well before the formal price book announcement is published. Since the lengthy qualification cycle of many programs places their last procurement outside our active sales history file, we also send an industry-wide notification through the GIDEP system. Where we have program parts lists, we also review those and ensure that the OEMs responsible for those parts lists are notified.

During the notification cycle, we begin to stockpile wafers and to assembly product based on our visibility into the product demand. We actually increase our production volumes in order to compress several years worth of production into a much shorter period. In some cases, we establish large wafer inventories that will allow us to delay the obsolescence of the military device for several years. We will normally approach all known customers at that time to get their estimates of their long term need. We cannot keep a device in production forever, but we can continue to build it until the majority of demand is satisfied.

I know the question that's coming next. Somone will say, "That *sounds* wonderful, buuuuut my program still ran into a brick wall when it tried to a device that was critical to the system we designed. What happened?"

Several things may have happened. Tracking a program parts list to source control drawing numbers may have prevented identification of the obsoleted device as one the program used. The system manufacturer may not have notified the end customer (who now has to maintain the system, that a part was obsoleted. A program may have prototyped with commercial parts purchased through distributors, so that we were never aware of the program's needs. There are other similar causes, but they all share one common element. All were preventable. A system manufacturer who designs and manages his program with

obsolescence in mind can avoid the snares technology evolution might set for a less forward-planning program. I'll come back to that, but first I want to mention one other step we take.

The Sunset Sources. Once we have closed the LTB window and filled all the orders received during that period, we don't simply turn our backs and walk away. We have found that needs mysteriously arise after we've exited the business. To provide for those needs, we work closely with "sunset technology" houses. These companies are set up to process small productions runs of many different fab processes -- the sort of capability no high volume IC house could afford to maintain. We not only transfer all of our residual dice and finsihed goods to such companies (Rochester Electronics is National's primary "sunset source"), we also transfer fab, assembly and test capabilities.

The products a "sunset house" sells are manufactured almost identically to the ones we once sold. They have to be. They're using our specs. Several programs in recent years have created configurable chips that can be used to emulate any obsolete product. Those might be viable in cases of absolute desperation, but they should never be employed where a firm like Rochester still has the device in production. I've heard complaints of differences in price between what an IC company once charged and what a sunset house now charges, but those complaints fail to acknowledge the difference in manufacturing volume and the amount of overhead that must be absorbed per part. The prices charged by the sunset technology houses are extremely reasonble given everything that goes into them, and they are certainly much lower than what it costs to emulate an obsolete part.

Managing Obsolescence. The critical item, from a system designer's standpoint, is to avoid as much of this problem as possible. Most of the bad situations everyone fights do not have to occur. Intelligent planning at the front end of a program will prevent many of them. There are three areas in which a little foresight can eliminate large investments in recovery effort in the future. The first is vendor selection, the second is device selection, and the third is parts management.

Vendor selection should precede, *not follow*, device selection. While it may be easier for an engineer to take the IC Master from the shelf and select the part closest to his concept of the ideal part for the application, that choice may prove harder in the long run. A device whose manufacturer does not support it for military applications will require expensive and potentially dangerous work-arounds to make it compatible with the reliability and screening specifications in place for the program. A program may be better off with a less-than-ideal device that is procurable in the configuration and with the screening desired. Vendor selection can help assure that.

There are three basic rules of vendor selection. First, focus on vendors who are committed to reliability screening, standardization and support of the military/aerospace market. Those are the vendors who will be there for the long haul. They also understand the demands of your applications. An aircraft presents environmental constraints that are non-existant in the commercial sector. You want to buy your parts from someone who understands those constraints.

Second, if the focus is long-term availability, it would be wise to look at a vendor's obsolescence policy. A vendor without a corporate policy that clearly defines obsolescence procedures, customer notification policies and life-time buy durations can provide some unpleasant surprises during a program's life cycle.

Third, and perhaps most important, a potential vendor should be asked to describe his corporate design migration philosophy. New products should be downward compatible. Applications that used the previous generation of a product should still run if the new product is substituted for the old. A manufacturer who fails to ensure this has no design migration philosophy. He is unwilling to guarantee his customers that their designs will be procurable for the long term. While no manufacturer can guarantee he will maintain a specific product for any given period, he should provide reasonable assurances that he will transition product functionality forward as he introduces enhanced products and improved processes.

Product Selection. Many obsolescence problems encountered by any program could have been prevented by more careful product selection. Most bad selections occur when the system designers fail to talk to suppliers during the parts selection process. National, as a company, realized this very early. We

were one of the first IC firms to invest heavily in a field applications engineering force. We realized we could help our customers by providing personnel who coupled experience in system and sub-system design with a thorough understanding of our products and their performance potential. FAEs are an important asset to any designer who shares his design plans and design constraints with them.

But they shouldn't be the designer's only point of contact with an IC supplier. Marketing personnel are not only knowledsgable regarding existing products -- they know what's coming. They can work with FAEs to help a designer prototype with an existing product in a way that will allow him to transition his design to an as yet unreleased product that will enhance system performance (and remain available far longer than the current product).

It's also important to talk to the management of the IC firms that will represent the major portion of a design. Management discussions accomplish three critical objectives. They help program personnel understand the long term product and market plans of the IC manufacturer. Second, they help program personnel to understand that firm's level of commitment to the market. It should surprise no one that there are too many IC suppliers whose commitment to aerospace and defense does not extend much beyond this week's billings. Third, management interchange can foster a cooperative teamwork rather than the traditional hands-off buyer-seller relationship. At National, we don't want to merely supply components to our customers' programs, we want to become part of each program team. That's not an altruistic attitude. Our success is linked to our customers' success. The more we help each customer to achieve his objectives, the greater our own return will be. Close communications benefit both of us. A program design team that develops close links with IC suppliers early in the design phase will clearly enhance its chances of success.

The first message they receive during that process may be one of the most critical warnings: don't select commercial products. I need to clarify that. The Packard Commission indicated a decade ago that DoD needed to better utilize commercial technology. Secretary of Defense Bill Perry has reemphasized that message, and is trying to implement it. But we must understand what that means. I mentioned earlier that National' mil/aero products all use dice fabricated on commercial lines. Anyone who watched the transition in military IC specifications over the last ten years saw significant progress in tailoring those specifications to improvements in commercial process technology that enabled the IC industry to achieve incredible quality levels. That process will continue within Dr. Perry's new mandate.

But that's different than buying commercial products. The applications we're discussing here are all intended for harsh operating environments -- the heat and vibration of fighter aircraft, the saline humidity that surrounds a Navy ship, the dust and shock of a battlefield. Those environments are inescapable. They will continue to require hermetic packaging, extended temperature ranges and some confirmation of product reliability. (As an aside, we at National feel that will be best accomplished through increased reliance on QML and on MIL-STD-883, but that's a subject for a different forum.) Commercial products offer limited temperature range, molded packages (which will be viable for some, but not all, applications) and slightly relaxed quality and reliability specifications.

This is actually a subset of the communications issue. A supplier can tell his customer whether a device will be available in a military configuration, with the proper support, packaging and testing. If the commitment is there, it is practical to prototype with a commercial part, knowing the military part will be available in time. But no designer should make that assumption. Nor should a designer plan to use an "upgraded" commercial part because he thinks he cannot achieve his design targets without it. Added screening of a commercial part only results in a better commercial part -- not a true military part. And there is a greater risk: no one is focussed on that device for long-term applications. When commercial demand wains, the part will disappear unceremoniously and one more critical program will be left standing in the hurricane of panic.

Mature military products should also be approached with caution. Communications and the supplier selection criteria mentioned above are critical here as well. Many of today's mature products may be gone in five years. Some will still be in production in 2014. A look at National's 1974 data books would show some interesting trends. Many linear devices offered then are still available today. Only a few logic devices survive. None of the memories lasted past 1980. Assessing a mature device's long-term prospects should be a key element in product selection. Where a manufacturer plans to discontinue a device

near term, he should know what its planned replacement will be. If plans no no replacement device, it will be better to rule it out today than to undertake a radical redesign to accomodate its termination downstream.

The products that will provide the fewest problems are new products from committed suppliers who have defined design migration paths within their corporate product development philosophy. It all comes back to communications and supplier selection.

Systems designers can take one additional step to reduce the number of problems later: provide copies of parts lists (even preliminary and provisional lists) to their major suppliers. I assure you we will review those lists. Suppliers can provide valuable feedback when they know what you plan to use. The parts list should be the *entire* parts list, not just that portion showing products for that specific supplier. In some cases, we have feedback from desaigners on the commercial side that certain parts do not work well together. We may alsd know of parts other plan to obsolete. We may know of newer implementations of a particular circuit function that are better suited to a particular system's needs. An IC manufacturer can be of far more help when he is involved early in the part selection and documentation process than he can when all he sees is an RFQ after the design is locked in concrete.

Subsequent to Design. A systems manufacturer can take several actions to help avoid severe problems resulting from product obsolescence as his system matures. The first, and most obvious, is that he should subscribe to the GIDEP system (and ensure that all of his suppliers provide notices to GIDEP when they discontinue products).

For GIDEP to be effective, he should make several internal changes (if he has not already done so). The first is to maintain a usage data base keyed to *standard industry part numbers.* Too many programs track only the program assigned part number (or source control drawing number). The single most significant cause of a program's inability to note obsolescence when it occurs has always been that the part numbers don't match. Suddenly, a year after the life-time buy window has closed and the product has gone to IC heaven, someone realizes that 81A04B77-011 is *really* an ABC0044. And it's too late to do anything. Parts should never be tracked under internally created aliases.

For the same reason, a system contractor should consolidate all of his subcontractors' parts lists into a program master parts list (with the using subcontractors clearly identified). That list should be provided to key suppliers. The list will facilitate two processes. First, the prime contractor can ensure that every subcontractor is aware of an impending obsolescence. Second, each supplier can ensure that he includes those subcontractors in his direct notification.

It is also critical for a system designer to alert his IC suppliers when a planned program upgrade is scheduled. At National, when we know that a system will soon go through redesign, we review the existing system parts list to identify products whose current longevity is questionable and to assist in the upgrade by identifying new products that will support the improved performance objectives defined for the upgrade. An upgrade is the ideal time to eliminate those devices that might not be available in a few years.

Summary. Obsolescence is inevitable as semiconductor technology advancements. But it need not be catastrophic for any program. Communications, intelligent supplier selection and cautious component selection can eliminate many pitfalls. Many of us in the IC industry are committed to meeting the needs of our customers even when their programs have much longer life cycles than one finds in the commercial sector. But we cannot meet those commitments unless we work closely with our customers from the earliest stages of their programs. We are indeed all in this together.

2.1.20 NSSC (Naval Supply Systems Command), Washington D.C

SITE VISIT REPORT

CATEGORY	:	DoD Agency
COMPANY/COMMAND	:	NSSC (Naval Supply Systems Command), Washington D.C
POINT OF CONTACT	:	Fred Haub, (703) 607-0944
DATE	:	9/13/94

Naval Supply Systems Command oversees the Ships Parts Control Center (SPCC) and the Aviation Supply Office (ASO) operations. SPCC and ASO have Cognizant Item Managers for various parts used within naval platforms. These parts are mainly non consumable type items. Support for consumable items has been moved to DLA. NAVSUP is at the same level of command as NAVSEA and NAVAIR. NAVSEA and NAVAIR focus on equipment while SPCC and ASO focus on replacement end-items, from nuts and bolts to complete systems.

According to Mr. Haub, DMS issues are continuing to gain in visibility and funding within the Navy. The finalization of a DMS information exchange database to be built by GIDEP points out how far DMS has come in recognition as a DoD wide problem. The GIDEP based system will provide a means by which various DoD agencies will be able to list DMS problems and solutions. This system will help agencies to communicate their solution paths and thus go a long way towards reducing the needless duplication of efforts.

The DMS information exchange database will assist NAVSUP in gaining a higher level perspective of the amount of DMS activity and the various solution paths that are being implemented. This will assist NAVSUP as well as other DoD managers with keeping track of DMS and its effects on various programs.

This system's design and integration with a Navy wide predictive tool will be discussed in other site visits, namely NUWC, Keyport and GIDEP, Washington D.C.

Mr. Haub stated that funding for DMS problem solving is increasing and will continue to increase at a rapid pace. Eventually, every end-item will have a "DMS Manager" assigned to it. These managers will continuously monitor their end items for DMS threats. This dedication of personnel should allow for a more rapid and less costly approach to solving DMS problems.

Various existing DoD databases were discussed regarding the suitability for integration into a DMS predictive tool system. Vast amounts of historical purchasing data is available through IPCNET as well as current inventories and their locations. WSF, among others provide hierarchical breakdown part lists for weapon platforms. HM&E (Hull Mechanical & Electrical) data is also available for inclusion. Further research into structure and accuracy of this information will be needed.

Mr. Haub's view of an effective DMS predictive tool is one where an engineer would be able to enter a part number and have the computer printout the part's placement on a technology life cycle curve. Also included in the print out would be the number of manufacturers, the date the part was introduced to the market, and the part's DMS vulnerability.

The tool should allow system and platform wide analysis to assist high-level DoD managers in prioritizing platform updates and replacement.

What is needed according to Mr. Haub is a policy change. The new policy would be to implement a preplanned improvement program Navy wide that would schedule the updating and replacement of weapon platforms before DMS problems became unbearable. This, according to Mr. Haub is unlikely to happen, referencing the traditional way the money is allocated by congress and the shifting priorities of presidential administrations.

What is also needed, and more likely to occur is a strong DMS program that includes value engineering as a cornerstone. Value engineering at the beginning of a design process to reduce the possibilities of DMS problems from occurring in the future.

2.1.21 NSWC (Naval Surface Warfare Center), Dahlgren, VA

SITE VISIT REPORT

CATEGORY	:	DoD Agency
COMPANY/COMMAND	:	NSWC (Naval Surface Warfare Center), Dahlgren, VA
POINTS OF CONTACT	:	Chris Vaughan
DATE	:	10/11/94

This meeting was held at Naval Surface Warfare Center, Dahlgren, VA. Chris is involved in solving DMS problems for the Standard Missile program. Standard Missile is about to go through a major cut back in production. There is concern as to whether the two suppliers of the missile can sustain production at this lower volume. Standard Missile relies on the contractors for DMS management and has little capability in this area. The program office is of the opinion that DMS is the contractor's problem. Since missiles are considered expendable, production support is of greater importance than spares support.

2.1.22 NSWC (Naval Surface Warfare Center), Port Hueneme, CA

SITE VISIT REPORT

CATEGORY	:	DoD Agency
COMPANY/COMMAND	:	NSWC (Naval Surface Warfare Center), Port Hueneme, CA
POINTS OF CONTACT	:	Jerry Martinez - NSWC, Jeff Hanser, Bruce Blackford - RAC (619) 282-2265
DATE	:	9/30/94

This meeting was held at TACTech, Inc., in Yorba Linda, California. In attendance were Jerry Martinez who heads up the DMSMS effort at NSWC, Jeff Hanser and Bruce Blackford of Research Analysis Corporate (RAC). RAC is based in San Diego, California. RAC has written the Health Model system that is in use at NSWC, Port Hueneme.

The Health Model is an automated tracking system for weapon platforms. The Health Model tracks and produces assessments on a system's Obsolescence, Return on Investment, Readiness, High Cost Items, High Demand Items, and Supply Support. The system contains a configuration data file that lists all of the parts utilized on the weapon platform. External sources of data, such as repair and failure information are then fed in electronically on a periodic basis from military databases and commercial databases. A flow diagram is included at the end of this report and labeled "RAC/PHD-NSWC HEALTH MODEL DATABASE FLOW DIAGRAM."

Another flow chart labeled "OBSOLESCENCE FLOW CHART" has been included at the end of this report. This chart details the position of the Health Model within the DMSMS workflow pattern. External data sources are listed to the left of the chart while internal data sources, those sources directly involved with the support of the weapon system, are listed at the top. Through the Health Model obsolete or problem parts are identified. One of the many solution paths is then chosen to solve the problem. Eventually the change that occurs is recorded within the Health Model database.

The Health Model is not a predictive tool, but a monitoring and analysis tool. It can't tell the user what will be a problem in two or three years, but can tell the user what the problems are today. The model uses 7 equations, one for each aspect of the assessment and monitoring process. Each of the equations have weighting

factors that are being tuned during the Health Model's development. These weighting factors attempt to set thresholds such that the user is neither inundated with alerts nor missing key alerts.

The formulas are simple ratios such as: The number of parts used per month divided by the number of ships the equipment is used on. Each of the seven formulas result in a value between 1 and 20, where 1 is considered to be very safe from DMSMS and 10 is considered a problem requiring attention.

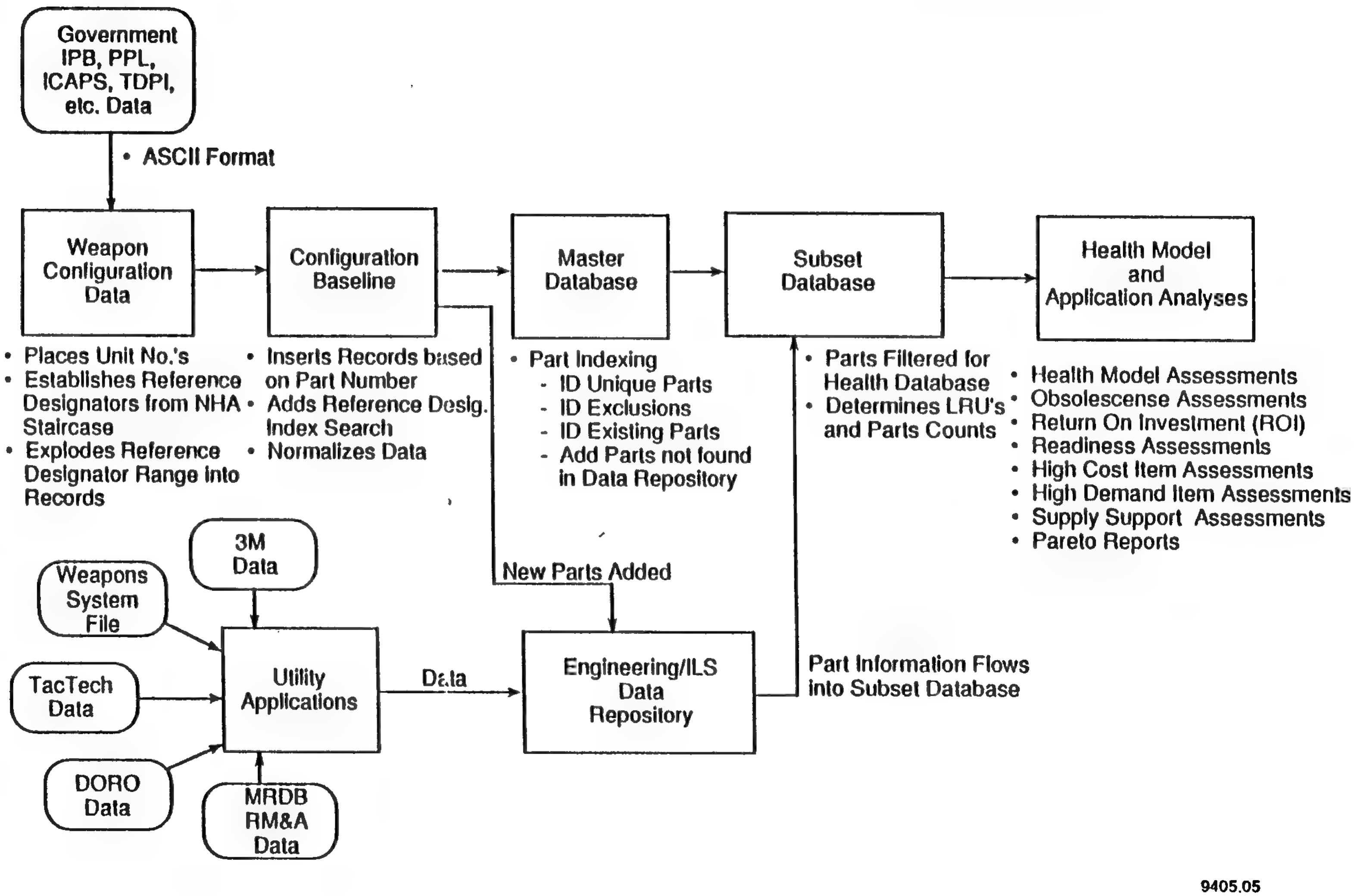
Once problems are detected, the Health Model provides a vast amount of information on a part-by-part basis. This data includes MTBF, MTTR, cost, amount in inventory, usage patterns, and availability.

The Health Model works with any kind of component, both electronic as well as mechanical. The weapon system configuration is filtered into key subsets of components so that resources can be focused on parts that have a high probability of becoming DMSMS problems. The focus currently is on electronic components which NSWC considers to be the biggest problem.

Future expansion of the Health Model will include a move to a GUI interface, the incorporation of more data sources such as CRAMSI, and the HEDERS file for additional support on mechanical obsolescence. Another function that needs to be added to the Health Model is a DMSMS case management system. The case management system would track each problem part through to a solution thus providing a growing library of solution paths that would be of great value as similar problem parts are detected.

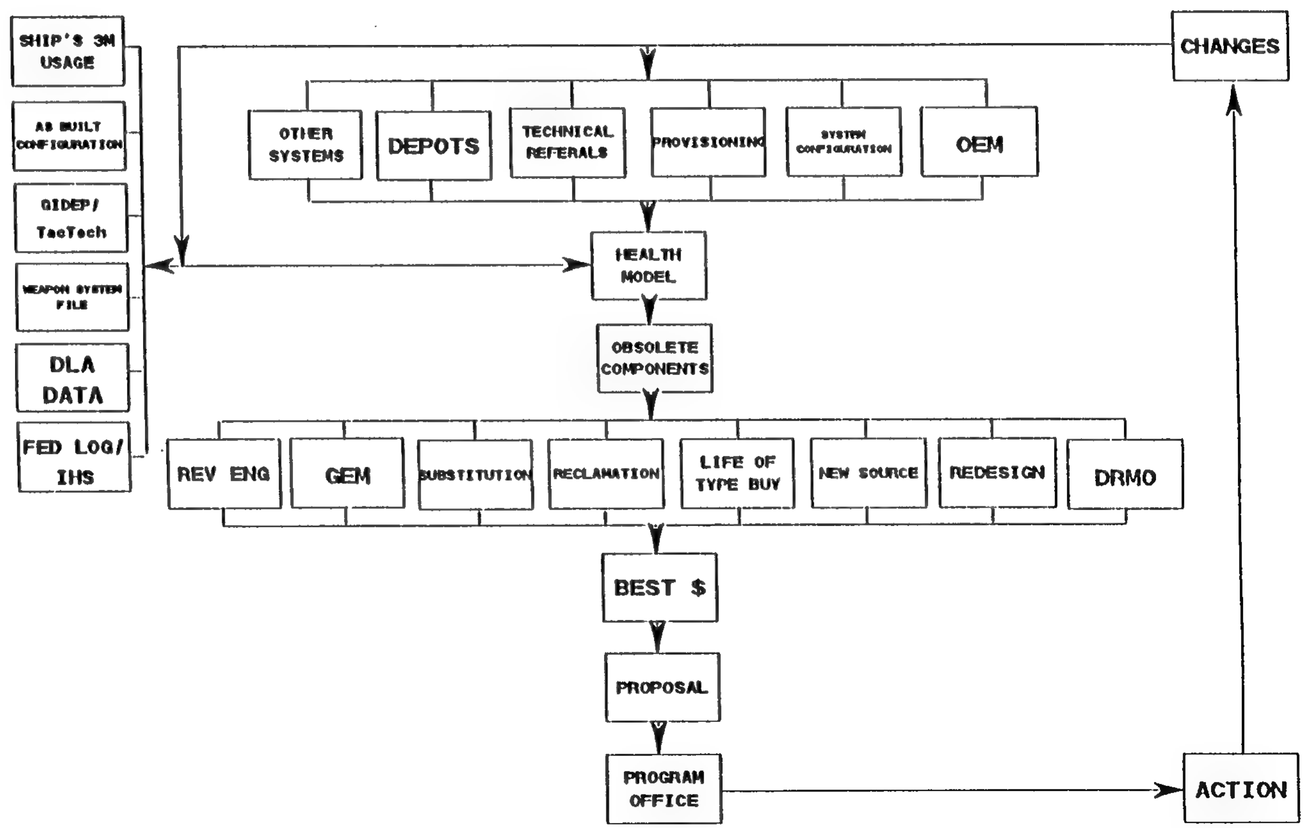
The Health Model does provide a good tracking system for other types of data as well as a centralized 'one-stop-shop' library for the weapon system. These functions would round out a predictive DMSMS tool by providing a central point of data gathering that can be easily researched for solving the projected DMSMS problems. Further discussions will be held as to the possibility of working with RAC and NSWC-Port Hueneme regarding a pilot project.

RAC/PHD-NSWC
HEALTH MODEL DATABASE FLOW DIAGRAM



OBSOLESCENCE

FLOW CHART



2.1.23 NUWC (Naval Undersea Warfare Center), Keyport, WA

SITE VISIT REPORT

CATEGORY	:	DoD Agency
COMPANY/COMMAND	:	NUWC (Naval Undersea Warfare Center), Keyport, WA
POINTS OF CONTACT	:	Judy LaFountaine, Jeff Ericson
DATE	:	8/30/94

This meeting was held at Naval Undersea Warfare Center, Keyport, Washington. The meeting was attended by Judy LaFountaine and Jeff Ericson who head the DMSMS center.

NUWC, Keyport has a mature and robust DMSMS effort. This effort includes the development of a custom built tracking and analysis system for DMSMS detection and solution. The automated system resides on a network of Personal Computers at NUWC. The software was developed 'in-house' at naval expense. The system is currently DOS based but transition to a Windows environment is underway.

The main focus of the DMSMS effort is electronic components since according to both Ms. LaFountaine and Mr. Ericson 99.9% of the DMSMS problems they have encountered over the last four years have been for electronic components. NUWC-Keyport has handled over 400 DMSMS cases within the past 4 years. This is compared to 47 cases handled by DISC during the same period (see the site visit report to DISC for more detail).

According to Mr. Ericson, identification of DMSMS problems comes mainly from the production line's prime contractors. This is due to the large number of systems that NUWC is working are currently in production. The source of DMSMS problem notices is expected to shift to the repair facilities once production has ceased. Automation is seen as the most cost effective means to handle the DMSMS workflow. Automation allows for data to be consolidated, and for rational timely decisions. Shortening the time to react and solve DMSMS problems is seen as a key. Also Mr. Ericson pointed out that the solution today will most likely not be the best solution for the same problem tomorrow. For example a redesign of a module may make sense today, but if the system is being phased out of the navy two years from now, reclamation from working spares may be the best solution.

NUWC-Keyport has an extensive DMSMS program of which their automated system is but a small part. A diagram of this program is attached to the end of this report. The

program is well thought out and follows a logical progression.

The ECTA or Electronic Component Technical Analysis is the heart of the automated system. The ECTA system utilizes data from the prime and program office regarding the actual component contents on board a weapon system. ECTA also obtains data from external sources such as MOMS, GIDEP, TACTech, Inventory Databases, Haystack and CAPS. This data provides an ongoing monitoring of the various weapon systems parts lists in order to alert NUWC to new potential DMSMS threats. The ECTA also produces an analysis that utilizes TACTech's DMSMS prediction model to proactively evaluate a parts list for DMSMS future threats. An example of a module analysis summary is attached to the end of this site visit report.

The ECTA is backed up by an extensive DMSMS case tracking system. An example case is included at the end of this site visit report. This system allows NUWC engineers the ability to track and store solutions to DMSMS problems on a part-by-part basis. Management reports are available that track the open cases as well as statistics regarding resolved cases.

NUWC-Keyport has worked mainly under project type contracts. These projects provide funding for the ECTA and case resolutions but are sporadic in nature. NUWC is attempting to gain acceptance as a service bureau to other navy programs and also other DoD programs. Workflow is expected to increase dramatically over the next few years.

Although the DMSMS system is mature, it does lack the broad based view of the Health Model at NSWC-Port Hueneme which tracks aspects such as price changes, high usage parts, supply changes, MTBF, MTTR, etc. However the NSWC-Port Hueneme is lacking a DMSMS case management system and predictive analysis tool found at Keyport. Another item lacking in the Keyport system is a top down perspective such as that taken by the HONE program. Although HONE's work is done on a more project-by-project basis and is thus not highly automated, the availability of a top-down view data could greatly assist DMSMS case workers in choosing the best DMSMS solution. By bringing all of these pieces together, a more complete and seamless solution could be obtained.

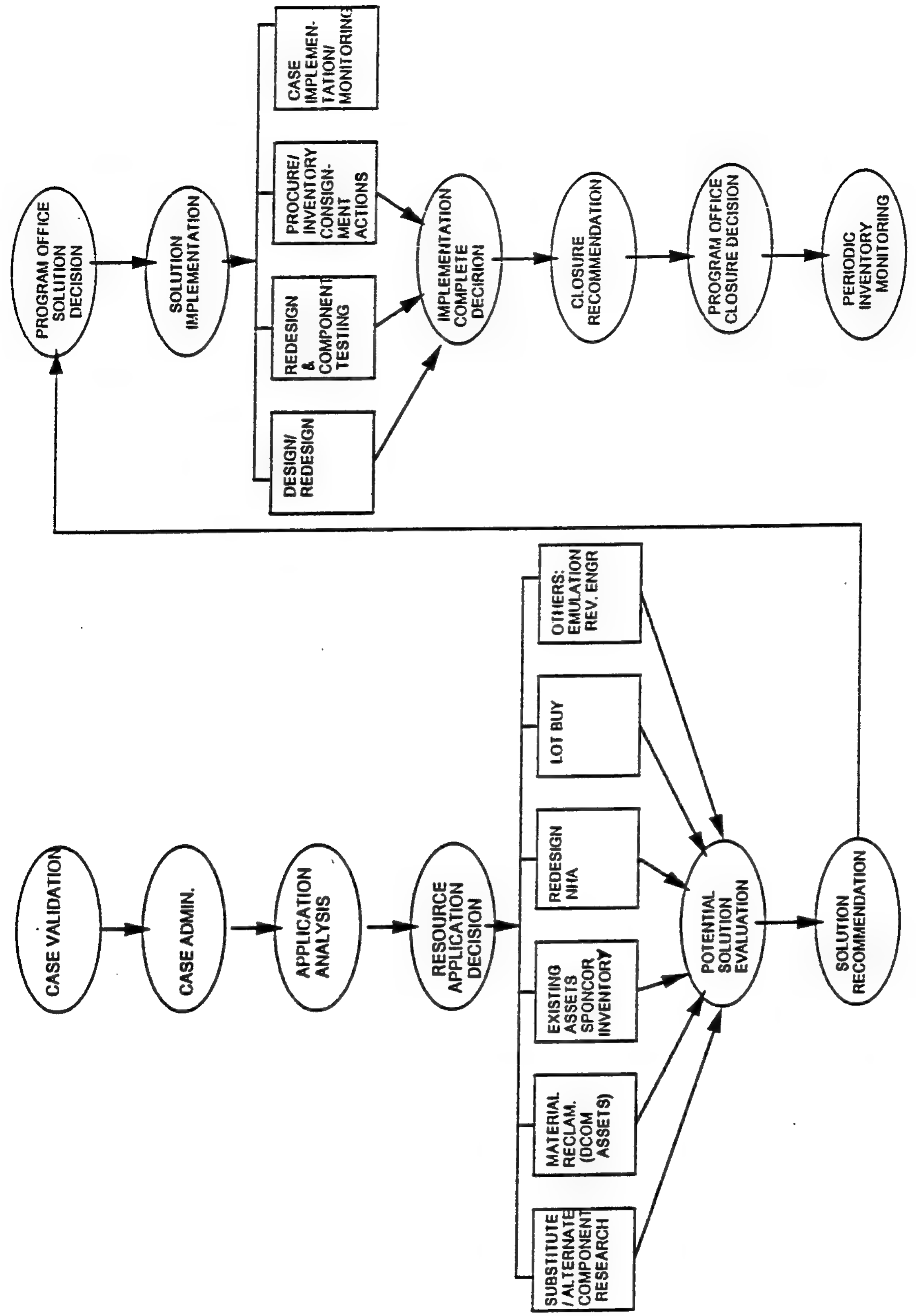


FIGURE 1

CURRENT DMSMS PROCESS

MODULE SUMMARY DATA

MODULE P/N	NO. ASSESSED COMPONENTS	AVG TACTEC LC CODE	ASMT CODE BY %					TOTAL CASES	OPEN CASES
			O	N	S	M	U		
2871302-1	27	3.02	0.0 %	0.0 %	44.4%	55.6%	0.0 %	3	3
6132007-3	3	2.50	0.0%	0.0%	0.0%	66.7%	0.0%	0	0
8006950	1	3.00	0.0%	0.0%	0.0%	100.0%	0.0%	0	0
8016515	1	3.00	0.0%	0.0%	0.0%	100.0%	0.0%	0	0
Variance =		0.07	0.0%	0.2%	5.7%	5.9%	0.2%	2.68	1.94
Standard Deviation =		0.26	1.6%	4.9%	23.9%	24.2%	4.1%	1.64	1.39
Average =		3.12	0.4%	2.3%	30.0%	63.8%	0.5%	1.77	1.34

TACTech Life Cycle (LC) Codes:
(Based on Device Technology)

1.0 - Introduction of Technology
2.0 - Growth of Technology
3.0 - Maturity of Technology
4.0 - Saturation of Technology
5.0 - Decline of Technology

ASSESSMENT (ASMT) Codes:
(Based on Device Technology)

D - Design In - New Technology Component
M - Maturity - A 5+ Year Projected Availability
S - Suspect - 3-5 Years Projected Availability
N - Near-Obsolete - 1-3 Years Projected Availability
O - Obsolete - Less Than 1 Year or Gone

CASE NUMBER: 060-02-93-A

DATE RECEIVED: 02/04/93 ENG/TECH: AM/MM PROGRAM:Sonar

PART NUMBER: 6134459-1
NOMENCLATURE: AGC Amplifier
NSN: None
VENDOR: Plessey

GENERIC P/N: 2155A
VENDOR P/N: MOF-2155A

APPLICATION DATA

PART NUMBER	QTY	NEXT ASSY	QTY	KCODE	EQUIPMENT	SYSTEM
6134459-1	1	2833450	4		Unit 116	BQQ-5B,C,D,E(V)3
6134459-1	1	2833450	5		Unit 118	BQQ-5C,D,E(V)3
6134459-1	1	2833450	2		Unit 31	BQQ-5E(V)4
6134459-1	1	2833450	1		Unit 16	BQQ-6
6134459-1	1	2833450	1		Unit 17	BQQ-6

STATUS

02/08/93

Using configuration manuals, application of 2833450 was identified in Unit 31 of E(V)4, Unit 116 of B,C,D,E(V)3, Unit 118 of C,D,E(V)3, and Units 016 and 017 of BQQ-6.

Support requirements thru 2005 will require 75 pcs of 6134459-1.

Plessey was contacted and verified this device has been "archived". It may be possible to have a production run made if requirements are sufficient to warrant.

No sub/alt part or SOS can be identified.

03/10/93

Discussed requirements for the next higher assembly with supply support personnel (code 4112). Contract N00024-93-C-6501 identifies one EAN module as government furnished equipment for the MAMs kit to be used on SCLIN 0001AH. A possible additional requirement for 18 modules to be used in a trainer upgrade was also identified. Some reclamation possibilities exist, as 2 each of this module were used in Unit 130, all of which have been removed from active systems.

03/11/93

Zone quantities of NHA where checked. There are zero RFI and zero in reclamation. There are 20 returned modules which may have failures other than component 6134459-1 that could be repaired.

03/12/93	Federal Supply assets of the NHA was checked. NSN 5963-01-057-8501 has a total of 169 on hand. The BRF is .0250 and the cost is $1800 each. These are "9N" cog (non-repairable) items, but IBM data indicates this module is repairable.
03/15/93	Reclamation quantities received from Supply Support personnel (Code 4112). A total of 24 EAN modules were removed from decom unit 116s and 18 EAN modules were removed from unit 130s. All Unit 130s have been removed from fleet use. Calculation of NHA (EAN module) requirement was also performed. A total of 188 modules will be required for AN/BQQ-5 and AN/BQQ-6 support throught FY 2005.
04/01/93	Discussed status with IBM (F. Clater). IBM has contacted Regan-Compar about this device and initially received a "no-bid" on 3/24. but was contacted by Regan-Compar on 3/30 about the quantity that would be required. IBM component drawing 6134459 is at revision level "E" and NHA drawing 2833450 is at revision level "AC".
05/11/93	Discussed the possibility of transferring the NHA back to SPCC (Jill Young) and making this a repairable due to the unavailability of the component. Requested the point of contact at DESC and the process on how to transfer such module back to SPCC. Jill handed this action item to another person who later called and left a message. Mike Hall left a message indicating that he is working on this action item and will keep us informed. His phone number is 717-790-5939.
05/17/93	Received call from Kurt Ruhl, Plessey Semiconductor (516-393-8686 X 564). He stated that Plessey could revive IBM part 6134459-1 (Plessey MOS-2155A) for the following cost; $8.0K Retooling $6.0K Test Tapes $5.0 Masks $5.0K Burn-in $85.00 per part with 1000 piece min buy. Plessey has been in communication with IBM about this part. Mr. Ruhl will be out of the office until 5/20/93.
05/18/93	DLA was re-checked for on-hand and repair info. There are now 176 pcs of NHA 2833450 available in Federal Supply. This item was transfered to 9N COG (DLA) on 1 Apr and has a Material Control Code of 'M' (Medium Demand velocity, consumable). SM&R code is PA3DZ. The 'D' indicates the lowest level authorized for complete repair is Depot or overhaul facility and the 'Z' indicates the lowest level authorized to condem an item and/or service an item as Not repairable (when unservicable dispose).
05/19/93	Discussed the status with IBM (F. Clater). IBM has received the information from Plessey, but has some difficulty with the 1000 pc minimum quantity when they only show requirements for 30 modules at this time. They also have 3 in stock. Future forecast requirments are for 32 modules, but the driving factors behind that number were not

available. At present, lack of availability will cause an impact in Sept 93.

06/09/93	Contacted IBM (F. Clater) concerning the status of modules that are listed as "returned" in the BQQ-5/BQQ-6 Government Depot book, CDRL A009. F. Clater will check into the status of these modules and call back.
07/14/93	Discussed the status of P/Ns 6134460-1 and 6086427-4 with IBM (F. Clater). These components are used on the EAN module (2833450) and IBM encountered difficulty procuring these parts also. As IBM was unable to find a solution for P/N 6134459-1 (except for Plessey minimum buy issue), they requested that 30 EAN modules be provided as GFM. This request was accepted by the contracting office. To determine the status of the "returned" modules listed in CDRL A009, F. Clater suggested that we contact Colleen Harding at 703-367-5895. She is in the IBM Spares office, where that CDRL is generated.
07/28/93	Federal supply assets of NHA 2833450 (NSN 5963-01-057-8501) were checked. There are still 176 pcs available and it is assumed that 30 of these will be requested GFM by IBM. Remaining assets of 146 pcs will not meet projected support requirements of 188 pcs. Decommissioning schedule supplied by Mitch Hamrick identifies 2 BQQ-5B and 6 BQQ-5C boats as being removed from service in FY94. This action will make available 38 of the 2833450 module and more will become available as decommissioning continues. These reclaimed modules, in addition to existing assets, will continue to support the BQQ-5 system through it's LOS.
07/29/93	Keyport has shipped 40 reclaimed EAN modules to IBM to test and use them as GFM. Shipping document number 5163377892.
11/29/93	Recomputed life-cycle requirements of NHA, using new systems numbers. Requirements are; Total = 146, BQQ-5 = 142, BQQ-6 = 4. Checked federal supply system assets of NHA is 173. NHAs at Federal supply and NHAs from decommissionings will support life-cycle requirements. Case can be closed.
12/01/93	Called DESC, Bob Payton 513-296-5288, and informed him on NHA 2833450, NSN 5963-01-057-8501. He is informing the item manager about the parts DMSMS issue on this NHA. The navy is the only user of this NHA, the DESC price is $2166.40.
12/13/93	Case closure recommendation sent to PMO 42551.
03/17/94	Per letter dated 03/03/94, Ser 4255/0335, PMS425 to NUWC Keyport, case is closed.
03/30/94	Loral reports a "X" buy GFM requirement of 4 pcs of 2833450.

2.1.24 RAMP (Rapid Acquisition of Mechanical Parts), Crystal City, Arlington, VA

SITE VISIT REPORT

CATEGORY	:	Government Agency
COMPANY/COMMAND	:	RAMP (Rapid Acquisition of Mechanical Parts), crystal City, Arlington, VA
POINT OF CONTACT	:	Jason Hirsh
DATE	:	9/15/94

The RAMP (Rapid Acquisition of Manufactured Parts) program is an R&D project to integrate manufacturing and logistics functions using neutral nonproprietary digital data standards and management philosophies such as quality management, just in time deliveries and flexible work force. -- RAMP presentation dated September 14, 1994.

Once RAMP has been perfected, the ability will exist to take a mechanical part and replicate that part in a cost effective manner by utilizing extensive computer automation. This information will be passed to smaller commercial organizations. The plan is to assist smaller manufacturers in modernizing and incorporating the technology developed under the RAMP program.

The ultimate goal as stated by Mr. Hirsh, is to build a manufacturing infrastructure that is based on process capabilities instead of end item capabilities as it is today. For example, if more pump housings were needed and the original source was no longer willing or able to supply it, the housing could be "farmed" out to any organization that has the processing capability. As part of the RAMP program, the design for the housing would be converted into standardized electronic engineering documents, drawings, and numerical control sequencing. Through this use of standardization, the choice of suppliers is narrowed down to those with the correct computer controlled machines instead of, as would have been the case in this example, to commercial pump manufacturers.

Although grand in design, the RAMP program is making progress and already is able to turn out simple mechanical parts. Attention is now focused on more complex parts as well as printed wiring boards and cable harnesses.

As RAMP moves forward with new capabilities, it seems to be a natural fit for a DMS tracking and prediction system. It should be possible to create an automated system that would check the "fit" of the no longer procurable

mechanical part within the capabilities of the RAMP program and it's participants.

A centralized information resource should ultimately be developed that given a part description, material and process requirements, a computer system would automatically choose from a vast list of companies, those that would be involved in replicating that part. As with the GEM effort and its limited ability to emulate some integrated circuits, this automated system could point to solutions for many DMS mechanical parts.

RAMP is projected to validate data driven acquisition technology, integrate with related programs, accelerate commercial technology transfer, validate process improvement, expand other service involvement, and initiate identification of common manufacturing characteristics during fiscal 1995.

Major factors that are influencing the availability of mechanical parts according to Mr. Hirsh are EPA/OSHA regulations and the loss of major industrial segments due to the downsizing of the DoD.

By creating a process oriented, instead of program or component oriented manufacturing base, it is hoped that what little DoD oriented production that is left can be concentrated into the participating manufacturers thus keeping it economically feasible to remain in business. According to Mr. Hirsh, many no-bids for the manufacturing of spare mechanical parts are due to the uneconomical small runs that are requested. For example, a heat treatment oven may require hundreds of components to be treated simultaneously in order to make it cost effective to operate. If multiple program's parts could be concentrated into the processing of the manufacturer, the economies of scale would now make the heat treatment feasible thus reducing the costs to all involved.

The move towards a process oriented manufacturing base will have an extensive impact on mechanical DMS and it's associated costs.

2.1.25 Rockwell, Downey, CA

SITE VISIT REPORT

CATEGORY	:	DoD Contractor
COMPANY/COMMAND	:	Rockwell, Downey, CA
POINT OF CONTACT	:	Al Abrams, Requirements Engineering Analysis (310) 922-1683
DATE	:	8/4/1994

Summary

Rockwell International, Downey California is the prime contractor for NASA's Space Shuttle Maintenance and Refurbishing. Al Abrams heads up research projects. These projects analyze DMS issues and develop software for tracking of obsolescence across all categories of components, both electronic and mechanical. Rockwell has developed unique approaches to tracking and predicting DMS problems as they impact the ongoing shuttle launch and repair efforts.

Contacts

The two key contacts made during this visit were with Al Abrams who heads up the effort at Downey as a Logistics Technical Specialist and Sharon Woodruff, who is the principle programmer/analyst for developing automated tracking and prediction systems. Ms. Woodruff can be reached at (310) 922-3244.

NASA's Definition of Discontinuance

The unavailability of a part, material, or process is when it can no longer be procured at an 'affordable' cost.

DMS Tracking and Prediction Tool Development

Rockwell has developed some very unique DMS vulnerability prediction and tracking tools. The automated system is named PATS for Parts Availability and Tracking System. The prediction methodology is based upon NASA's definition of obsolescence which directly relates DMS to cost increases in production. The final results of a DMS vulnerability study is an easy to read, two dimensional matrix. An example of the matrix is located in Attachment 'A' at the end of this site visit report. The vertical axis of the matrix defines the "Level of Threat", High, Medium, Low. The Level of Threat categorizes the

difficulty and thus the cost of replacing the component. The horizontal axis places the components within the time frame that the discontinuance is expected to take place.

Each cell of the matrix contains the number of components within the LRU that fall into that range of threat and projected discontinuance. Each cell is itself numbered with an overall threat score, the cell that contains one or more components and has the highest score, sets the treat score for the entire LRU. By this means, priorities can be set as to the critical nature of the DMS problem on an LRU by LRU level.

PATS allows the user to select a cell and display the components that are placed within that cell's range. A very complete trail of information is available for each component including manufacturer, component description, process/materials, and threat code calculations. This information is also available in the form of a printed report, see Attachment B.

Application Environment

Rockwell's PATS system is operated within a 'closed-loop' environment. Once a DMS problem has been identified a team consisting of personnel from the Product Assurance (Quality Control), Logistics, Design Engineering, and Materials and Processing work together on the solution. Once a solution is formulated, that information is entered back into the PATS system to keep it accurate.

Basis for Prediction

The PATS system has two modules, the Environmental Module that is to be used for processes and materials, and the Technical Module that processes Electronic Devices.

The Environmental Module's obsolescence prediction is based upon market as well as regulatory influences on the production of a component. The PATs system contains a very complete database of EPA and California State Environmental regulations, see Attachment C, and their impact upon the availability and cost of chemicals, materials, and processes. Engineers study the regulatory trends and make best guess estimates as to when a given process or material will no longer be feasible for use.

For electronic devices, the Technology module utilizes market trend data that is obtained from TACTech at component level. Rockwell has developed their own threat code based upon the availability, secondary sources, and TACTech life-cycle code. This threat code is then used to

place the components within the final matrix.

How the PATS System Works

A 'top-down' approach is used in developing the data for the PATs system. In the example of the Space Shuttle, a hierarchical component list is created. Every type of component from gaskets and pump housings to diodes and microprocessors are contained within this database for the shuttle.

For parts that are non-electronic, the Environmental Module is used. Each component is classified as to the processes and materials that are used to create it. These processes are then broken into subprocesses, for example before a gasket is applied, the surface must be wiped clean with a special solvent and an adhesive must be placed on the surface. A unique list of chemicals and materials used in each subprocess is placed within the database. Because processes very slightly from manufacturer to manufacturer, each manufacturer's process must be checked to assure the accuracy of the data.

An ongoing effort takes place simultaneously. This effort focuses on the regulatory issues involved with the chemicals, materials, and processes used to make the components. This effort also analyzes the popularity of the particular processes that are utilized to manufacturer the components. For example, there are approximately 3 different methods which can be used to put an anodized coating on a metal part. The analysis reveals which method has the greatest longevity as well as popularity with in the manufacturing community and the variations in chemicals and materials used in the process. A numerical estimate as to the continued availability is established for each subprocess. Dependent upon the ease to which one method can be exchanged for another, or one material can be substituted for another, a "Level of Threat" code is also established.

Once the process, subprocess, and materials codes are developed, each assembly's DMS vulnerability can be calculated and its longevity predicted. Priorities for redesign and monitoring are established as well.

For electronic components, the Technology Module is used to produce the vulnerability analysis. Each component is checked against the TACTech database. A threat code is calculated based upon the availability status of the device, the number of secondary sources, and the TACTech life-cycle code. This threat code is then used to place the component within the DMS vulnerability

Project Status

The PATS system is in use as of the date of this report. New development for the PATS system is currently on hold pending further funding, although EPA and California State Regulatory information continues to be maintained. The system resides on standard IBM PC type personal computers and was written mainly in FoxPro under a DOS environment. Future development includes the completion of the "Safe" material substitutes for regulated materials database. The NASA Operational Environment Team (NOET) is proposing to integrate two other independently developed databases into the PATS Environmental Module. These databases are:

NASA Environmental Information System (NEIS) which track environmentally compliant research and technologies that are to replace current aerospace materials and processes

NESHAP, which houses a library of materials, usage amounts, chemical and physical property information, process, Federal VOC and HAP emission levels.

Access Availability

The PATS system can be tailored to meet the needs of other organizations. Please contact Al Abrams for further information.

ATTACHMENT 'A'

PART UNAVAILABILITY - ENVIRONMENTAL REGULATION IMPACTS
(NONMETALLIC MATERIALS)

DATE:11/28/1992

LRU:MC271-0074-0302
LRU NAME:LINE, LO2

SPARES: 0
REPAIR RATE: 0.0
POS REQ.: 0

#REPAIRS/CONDEMNATION: 0.0
EXPENDS: 0.000
SOURCE: N/F

	TIME UNTIL PROCESS/MATERIAL BECOMES UNAVAILABLE				
LEVEL OF THREAT	<1 YEAR	1-3 YEARS	4-6 YEARS	7-9 YEARS	>=10 YEARS
THREE REGULATION TYPES (POLLN,TOXIC,DISPOSAL)	0	0	0	1	0
TWO REGULATION TYPES	0	0	0	1	0
ONE REGULATION TYPE	0	0	2	0	0

ATTACHMENT 'B'

ENVIRONMENTAL REGULATIONS IMPACTS
(NON-METALLIC MATERIALS PROCESSES)

PAGE 1
DATE:11/28/1992

LRU:MC271-0074-0302 LINE, L02

SPARES: 0 | POS REQ.: 0

REPAIR RATE: 0.0 | EXPENDS: 0.000

#REPAIRS/CONDEMNATION: 0.0 | SOURCE:N/F

MATERIAL CODE	DESIGNATION	HAZARDOUS COMPONENT	SAFETY SHEET	REGULATION REFERENCE	TOX	POLN	DISP	ESTIMATED THREAT DATE	WEIGHTED THREAT	MATERIAL MANUFACTURER
OBSOLESCENCE THREAT WITHIN 1 YEAR										
OBSOLESCENCE THREAT WITHIN 1-3 YEARS										
OBSOLESCENCE THREAT WITHIN 4-6 YEARS										
00172	PRIMER SS4004 SILANE	ACE BNZ TOL	T	ABCD FGHIJK	X	X	X	/ /	5	GENERAL ELECTRIC
05214	SEALANT PR 1860 POLYURETHANE		T		X	X	X	/ /	5	
OBSOLESCENCE THREAT WITHIN 7-9 YEARS										
00005	ADHES EA828/VERSAMID 115 EPOXY	EPI EPX	F	DE G K	X			/ /	8	SHELL/HENKEL
OBSOLESCENCE THREAT WITHIN >=+10 YEARS										

ATTACHMENT 'C'

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY
CHEMICAL LIST OF LISTS - BY CHEMICAL NAME

Key to the headings in List of Lists

A: CALIFORNIA OSHA CARCINOGEN USER REGISTER CHEMICALS
Ref: California Occupational Safety and Health Dept.
(415) 703-3631 Date of List Jun 1990

B: EPA LIST OF PRIORITY POLLUTANTS
Ref: Environmental Protection Agency (EPA)
(415) 744-1911 Date of List Jul 1990

C: AB 1803 - WELL MONITORING CHEMICALS
Ref: California Department of Health Services
(916) 323-6111 Date of List Sept 1992

D: SARA SECTION 313 TOXIC CHEMICALS
Ref: EPA Emergency Planning and Community Right-to-Know Act,
Section 313 (800) 535-0202 Date of List Jan 1991

E: SARA SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES
Ref: EPA Emergency Planning and Community Right-to-Know Act,
Section 302 (800) 535-0202 Date of List Jan 1992

F: MCL (MAXIMUM CONTAMINANTS LEVELS) LIST OF CONTAMINANTS
Ref: California Department of Health Services
(510) 540-2177 Date of List Oct 1990

G: AB 2588 - AIR TOXICS "HOT SPOTS" CHEMICALS
Ref: California Air Resources Board
(916) 322-8278 Date of List Jan 1992

H: DHS DRINKING WATER ACTION LEVELS
Ref: California Department of Health Services
(510) 540-2177 Date of List Oct 1990

I: AB 1807 - TOXIC AIR CONTAMINANTS
Ref: California Air Resources Board
(916) 322-8278 Date of List Mar 1991

J: NESHAP (NATIONAL EMISSION STANDARD FOR HAZARDOUS AIR POLLUTANTS)
SPECIFIC CHEMICALS
Ref: EPA Office of Air Quality Planning and Standards
(919) 541-5647 Date of List Mar 1989

K: PROPOSITION 65 CHEMICALS
Ref: Office of Evironmental Health Hazard Assessment
(916) 445-6900 Date of List Oct 1992

L: DOT INHALATION HAZARD CHEMICALS
Ref: Department of Transportation
(916) 327-3310 Date of List Jul 1991

M: PERMISSIBLE EXPOSURE LIMITS FOR CHEMICAL CONTAMINANTS
Ref: Department of Industrial Relations
(415) 703-4050 Date of List June 1991

N: HAZARDOUS SUBSTANCES LIST (AKA "THE DIRECTOR'S LIST)
Ref: Department of Industrial Relations (CAL/OSHA)
(415) 703-4050 Date of List May 1990

2.1.26 SPCC (Ships Parts Control Center), Mechanicsburg, PA

SITE VISIT REPORT

CATEGORY	:	DoD Agency
COMPANY/COMMAND	:	SPCC (Ships Parts Control Center), Mechanicsburg, PA
POINTS OF CONTACT	:	James Fitsgibbon SPCC, Jim Gasvoda NSLC
DATE	:	10/12/94

This meeting was held at the Ships Parts Control Center in Mechanicsburg, PA.

In attendance was James Fitsgibbon who is heading up the DMSMS predictive tools SBIR project and Jim Gasvoda of the Naval Sea Logistics Center. Mr. Gasvoda heads up DMSMS for Engineering and Production.

Data resources that may be of value to the predictive tools system were discussed in detail. The WSF (Weapon Systems File) which includes ICPnet contains information regarding stock on hand, who uses it, NSN tracking to the ship level and BRF, MTBF failure reporting information. SCALESYS was brought up as another database that contains Naval configuration data. DELC was mentioned as the DLA's WSF equivalent on a DoD wide basis.

During this site visit, a tour of the databases was provided. Larry Kail thoroughly demonstrated the WSF's capability to track a small component's usage throughout the navy. This information included which ships it is used on, what equipment it can be found on, what was in stock, who it is purchased from, and whether it could be manufactured on board or only by the manufacturer. Mr. Kail is currently working on the Critical Codes Project. This project consists of breaking an item down to it's components and then applying a critical code to each part. These codes include such categories as difficulty in obtaining the part from another source, the complexity of a part, unique materials, processes, or configurations. This coding process has already been completed for a Gas Turbine engine. That project took 6 months. Mr. Kail is in department N92.

Later the meeting moved to SPCC's DMS control center. This department is staffed by Jill Yong, Betsy Graham, and George Sites. Their job is to take DMS notices from the DLA and assess the impact, if any, to the SPCC. They filter each alert through the WSF to see if the SPCC uses

the part. If it does they pass the notice on to those program managers that will be impacted by the discontinuance. The program managers then feed back to the group their life-of-type needs. This information is summarized and eventually fed back to DLA so that DLA can buy the appropriate amount of the item.

The group's major complaint about the way the operation works is that the time in which they are to report the needs of the SPCC is usually very short. The second problem encounter was mainly the vast amount of hand-entry and paper shuffling that was required to process these problems. When asked what percentage of the parts they encountered were electronic versus mechanical, they all agreed that electronics makes up 99% of their workload.

2.1.27 Texas Instruments, Midland, TX

SITE VISIT REPORT

CATEGORY	:	Component Manufacturer
COMPANY/COMMAND	:	Texas Instruments, Midland, TX
POINT OF CONTACT	:	Tom Smith (915) 561-6715
DATE	:	9/26/94

Tom Smith heads up the military product line of Texas Instruments. Mr. Smith listed the five most important reasons why TI obsoletes a component:

1. Wafer Fab Change -- A change made to a wafer fabrication line usually means the loss of easily replicating previously successful production runs of integrated circuits. Manufacturing is part science and part art, even small modifications can make it nearly impossible to create parts that meet the original specs. Needless to say this is a very expensive process to requalify a part on a modified line. Only chips with a high profit margin and/or high volume are considered as candidates for attempting to continue production.

2. Commercial Life-of-Type-Buy (LTB) -- Usually a Mil-Spec part is from the same die and fab line as a commercial version part. Once the demand for the commercial part drops to the point that it is discontinued, it is difficult to justify continued production for the Mil-Spec part due to the usually small sales volume. At this point TI takes one of two paths, either they build up a stock of wafers to meet the projected military needs or they announce a Life-of-Type-Buy. In either case, no future production runs will be made.

3. Demand CANNOT Sustain Continuous Production -- Continuous production is required to maintain profitable yields, thus once demand for a group of parts that use a unique process and fabrication line has declined to the point that it is no longer profitable, all production on the line ceases.

4. Unpredictable Yield or No Yield -- Parts that are difficult to make or for some reason can no longer be made to the original Specs (usually do to a change in the processing fabrication line) are prime candidates for discontinuance.

5. Can't Meet SMD Electrical Specifications -- If a competitor gets an SMD specification for a part and the approved specifications cannot be duplicated with a

form-fit-function part made by TI, TI will discontinue the manufacturing of that part at a Mil-Spec level (such as 883B rev C). This is due to the shift in demand from the non-standard 883B parts to the standard SMD parts by contractors.

Each quarter, TI reviews the "Distribution by Volume" report to assess which parts should be discontinued. The bottom 10% are likely candidates for life-of-type-buys. TI does maintain life cycle charts for its product families, see attached example. These charts are based upon sales volumes and design wins. Mr. Smith explained that the design wins were mainly used to determine the placement of the component family within the first two categories of the life cycle curve, Introduction and Growth. Sales volume is used more to determine the family's position within the last three categories, Maturity, Decline and Phase Out. No specific time frame is placed on the life cycle chart but commercial equivalent positioning is placed within parenthesis.

TI does print a code (A-D) for each component that they are actively selling. An 'A' code indicates that the part is being heavily used and has a relatively high demand volume. While a 'D' code indicates that the part has a very low volume and is a prime candidate for a life-of-type-buy. A detailed listing of the codes is attached to this report.

Given the above factors that determine when a part is to be discontinued, QML will have no effect on the current deluge of discontinued military integrated circuits. QML will only slightly reduce the costs incurred by manufacturers. Mainly those costs stemmed from non-value added testing of which QML does away with.

I asked Mr. Smith what would improve the DMS situation. He suggested that better estimates be given to TI as to future demand of a specific part. TI many times stocks an estimated supply of wafers at its own cost to meet the future demands of the Department of Defense. Many times the estimates provided to TI are very inaccurate. More accurate estimates would greatly increase TI's willingness to stockpile chips at no cost to the DoD. Secondly Mr. Smith suggested that the DoD heavily discourage the use of Source or Spec Control Drawings (SCD's). He estimates that less than 5% of SCD's are valid, that is they spell out a specific difference in performance. Reducing SCD's decreases the overhead of tracking and increases the likelihood that a Life-of-Type-Buy notice will be detected by a customer.

Another suggestion was the need for a "Dynamic Base Line Management" focusing new designs into using a smaller

selection of parts, thus keeping those parts' volumes at a profitable level.

Finally, Mr. Smith suggests that contracts should be on an ongoing basis. Contracts that are renewed yearly cause production procurements to be made over a period of years versus one large one up front. This spreading out of purchases increases the costs involved at many levels.

ACTIVITY CODES

Texas Instruments distribution activity codes are assigned based upon actual network resales and anticipated activity. They are designed to identify and facilitate distributor stocking as well as identify the primary devices that drive resales.

"A" and "B" devices account for over 90% of resales and less than 25% of the devices, thereby, identifying the parts that distributors should stock and devote their marketing and sales activity.

"C", "D", and "N" devices make up 75% of the Texas Instruments distributor released devices but account for less than 10% of the resales. For this reason, they should mostly be treated as commodity sales, quoting resales based on DBP as cost and minimize time transactions and resources devoted to securing resales.

TI device may also carry "S", "O", or "_" (blank) codes.

The following defines each activity code:

"A" While only about 15% of the devices listed in this book, "A" items make up 85% of the resales and are recommended for distribution stocking. Devices are price protected and may be returned under quarterly stock rotation privileges in factory sealed container only. There is a $250.00 line item minimum for order entry and distributors should order in multiples of "MOQ" (Minimum Order Quantity). Devices may be submitted for cost below DBP to meet market price.

"B" These devices have future potential to become "A" items and are treated in a similar manner. "B" devices are price protected, are recommended for stocking and may be returned under quarterly stock rotation privileges. "B" devices have a $250.00 order entry line item minimum and should be ordered in multiples of "SPQ" (Standard Pack Quantity). These devices also may be submitted for cost below DBP to meet market price.

"C" "C" devices make up about 8% of resales and therefore are not recommended for stocking. A distributor may choose to stock on customer specific basis without penalty, i.e., price protection is available on "C" devices if stocked and returns under stock rotation privilege are available. "C" items make up the commodity portion of Texas Instruments' Merged Commodity/Ship and Debit programs and no pricing below DBP is available. Distributors should quote all opportunities based upon DBP to support customer needs. Order entry minimum on "C" devices is $50.00 and distributors should order in multiples of SPQ (Standard Pack Quantity) only.

"D" "D" devices are very low volume devices and may be candidates for withdrawal. These devices are not recommended for stocking and may not be returned to TI after purchase. Order entry minimum has been reduced to $50.00 per line item and should be ordered in multiples of SPQ (Standard Pack Quantity). Price protection is not available and distributors should quote based upon DBP only.

"N" "N" devices are not recommended for stocking, however a distributor may choose to stock on a customer specific basis with complete distributor privileges. Includes most devices available on Tape and Reel as well as newly released devices not recommended for stocking. Devices are price protected and may be returned under quarterly stock privilege. Order entry minimum is $250.00 and should be ordered in multiples of SPQ (Standard Pack Quantity). "N" devices may submitted for below DBP cost to support competitive resales.

"R" "R" devices are new recommended for stocking and are first ordered on NPS (New Product Stocking) message the month of distribution release. Stock rotation returns are available under the 13 month return policy for newly released devices. Order entry minimum is $250.00 or per NPS message and should always be ordered in multiples of SPQ (Standard Pack Quantity). "R" items may be submitted for below DBP cost to support competitive resales.

"S" Identifies drop ship to customer only devices and no return privileges apply. Order entry minimum is $250.00 and distributors should order in multiples of SPQ (Standard Pack Quantity). Since these devices should not be in distributor inventories, price protection is available on factory approval basis only. "S" devices may be submitted for cost below DBP to meet competitive opportunities.

"_" or "O" Blank or obsolete devices will not be in "Suggested Resale Pricing Guide" (Costbook), but may be seen on MKP11 screen. Blank or "O" items indicate device is not a distributor item and should be treated similar to a "D" device with none of the Distribution device privileges.

NOTES:

All TTL (SN74XX) and Schottky/TTL (SN74SXX) devices are on commodity program and no pricing below DBP is available, regardless of activity code. Distributors should quote resales based upon DBP only.

All burn-in tested, PEP3 devices in commercial Linear and Logic groups have been listed as "D" devices and should be treated accordingly TI has NOT announced withdrawal plans for these devices.

2.2 Predictive Tools Survey Review

Review of DMS Predictive Tools listed in the "Obsolescence Predictive Tool Survey," Dated 20 August 1992

2.2.1 Summary

This article is a review of the "Obsolescence Predictive Tool Survey," produced by NAVSUP and dated August 20, 1992. This review brings current information regarding the predictive tools listed in the survey and looks further into what an effective predictive tool must incorporate as its key components.

2.2.2 Examination of Surveyed Tools

Of the various predictive tools reviewed in the Predictive Tool Survey, only three can be considered to be predictive. These tools will be the focus of the this updated review.

1. **Company: Westinghouse, Hunt Valley MD**
   Point of Contact: Buddy Marino, (301) 584-3104

Buddy Marino is still involved with Westinghouse Predictive Tool project. Although the predictive tools were to be placed into commercial service for use outside of Westinghouse, this plan has been scrapped due to a lack of interested purchasers. The tool is still used extensively by Westinghouse for their own contracts. The tool's information is obtained from various sources including internal operations such as procurement, GIDEP alerts, MOM's notices, TACTech data, and supplier bulletins. Mr. Marino indicated the a 'simplified approach' is used in developing the projected obsolescence codes at the component level. Engineering resources are used to analyze the availability of each part and its technology. Parts that are sole sourced are seen as more vulnerable to DMS problems as well as parts from older technological families. Accuracy is considered to be good, but no statistical analysis was available. The system works well according to Mr. Marino, especially at pin-pointing the usage of a component amongst various pieces of equipment. The use of multiple sources of information from various ongoing internal operations increases the possibility of locating a DMS problem early while keeping costs of maintaining such an information system low. Mr. Marino stressed that a key value to the system is its ability to quickly locate across multiple

pieces of hardware were the DMS problem component has been designed in thus allowing for the solution to take into account the extensiveness of the problem.

2. **U.S. AIR FORCE -- Minuteman Computerized Database**
POINT OF CONTACT: Dean Shiba (801) 777-1288
Hal Lines, TRW, (801) 777-7886

Work is continuing on the Minuteman Computerized Database which has been renamed to the Integrated Missile Database System (IMDBS). The project was moved last year from Boeing's facility in Seattle, Washington to Hill Air Force Base in Ogdon, Utah. TRW is still the contractor performing the work. The software and database is developed using Oracle on a DEC VAX platform.

The system monitors all components, electronic and mechanical, on every silo based ICBM down to the serial numbers associated with each item. The software contains configuration management and program management utilities.

The database contains additional information from test reports, procurements, engineering design changes, and depot repair history. The system does not address available spares inventories at the component level and has does not have predictive tools incorporated within the system.

The system software may be available to other DoD agencies. Inquiries are welcomed.

3. **COMPANY: TACTech Inc. Yorba Linda, CA**
POINT OF CONTACT: Mal Baca, (714) 974-7676

TACTech's predictive tools have been improved and expanded. TACTech's predictive tools database now covers all 19500 components. Additionally, TACTech is approximately 50% done with adding MTO, Industrial, and Commercial Microcircuits to the database as of the date of this review. Note, these microcircuits must have 883B, M38510, or SMD equivalents. The Microcircuit database now comprises a total of 85,000 components.

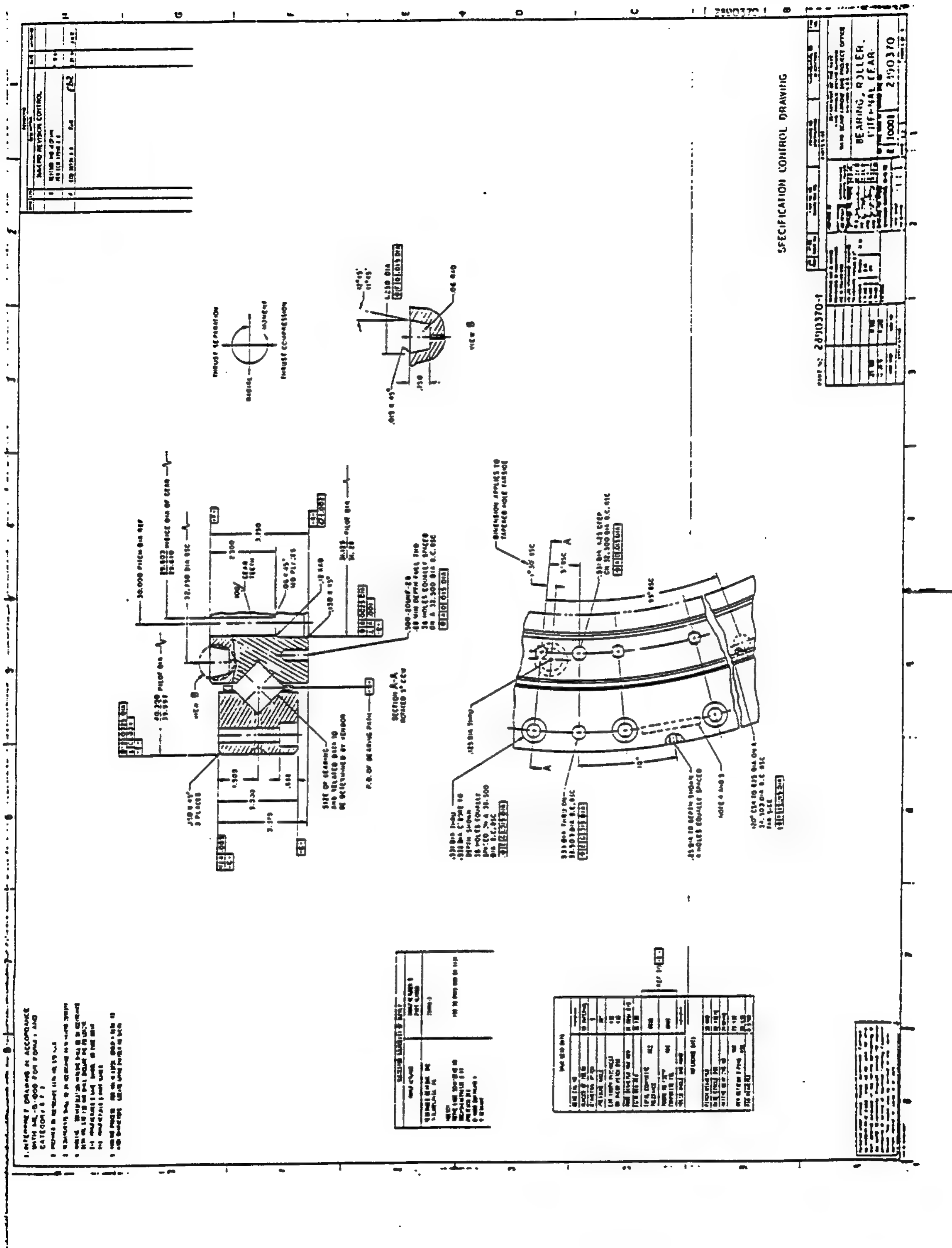
TACTech's software has been expanded to allow for easy data-sharing of analysis and parts list information among participating team members. For example, subcontractors can pass updated parts lists to contractors, who intern can pass these parts lists to the program office for review and pooling of alert notification. This ability now allows program offices and prime contractors to build extensive, accurate bills of materials across multiple pieces of equipment. This allows these offices to be able

to quickly assess the commonality of a DMS problem component.

Cost has remained relatively unchanged and access is still through standard dial-up telephone lines via a modem and PC.

APPENDIX 'A'

Nato Sea Sparrow Bearing: Example Drawings


SPECIFICATION CONTROL DRAWING
BEARING, ROLLER, INTERNAL GEAR
2890370
SECTION A-A
VIEW B
THRUST SEPARATION
THRUST COMPRESSION
RADIAL
MOMENT

APPLICATION	
NEXT ASSY	USED ON
2890370-_	

REVISIONS

LTR	DESCRIPTION	DATE	APPROVAL
-	ORIGINATED AND RELEASED PER RAYTHEON (BEDFORD) ER 1113026	4-7-70	[illegible] R. Marsh
A	REVISED PER RAYTHEON (BED) ER 1113033	7-8-70	[illegible]
B	REVISED PER RAYTHEON (BED) ER 1111408	5-7-71	[illegible]
C	REVISED PER BEDFORD ECA NO. NATO-174 AND BRISTOL ECO 7815.11	8-6-74	H. Bennett

INTERPRET DRAWING IN ACCORDANCE WITH MIL-D-1000 FOR FORM 1 AND CATEGORY D,F,J

PREPARED IN ACCORDANCE WITH MIL-STD-100A

REV STATUS OF SHEETS	REV LTR	C	B	A	C	B				
	SHEET NO.	1	2	3	4	5				

THIRD ANGLE PROJECTION

DIMENSIONS ARE IN INCHES DIMENSIONS IN PARENTHESIS ARE IN MILLIMETERS	PREPARED BY RAYTHEON COMPANY LEXINGTON MA-02173	DEPARTMENT OF THE NAVY NAVAL ORDNANCE SYSTEMS COMMAND NATO SEASPARROW SMS PROJECT OFFICE WASHINGTON, D.C. 20390
UNLESS OTHERWISE SPECIFIED TOLERANCES: ANGLES ±	CONTR NO. N00017-70-C-4409	BEARING, ROLLER, INTERNAL GEAR
DECIMALS / INCHES / M M	DR [illegible] 4/3/70	
3 PLACE ±	CHK R. Madsen 4/3/70	
2 PLACE ±	APPD [illegible] 4/3/70	
1 PLACE ±	APPD [illegible] 4/7/70	SIZE A / CODE IDENT NO. 10001 / NAVORD DWG NO. 2890371
MATERIAL: SEE 2.1	APPROVED FOR NSSMS	SCALE NONE / SHEET 1 OF 5

FORM NO. [illegible] (1/70)

D64014

[illegible]

2890371-1

1. DESCRIPTION: ROLLER BEARING, INTERNAL GEAR.

2. MECHANICAL REQUIREMENTS:

2.1 MATERIAL: MATERIAL SHALL BE USED THAT WILL ENABLE THE BEARING TO MEET THE REQUIREMENTS SPECIFIED HEREIN.

2.2 FINISH: THE BEARING SHALL BE COATED PER MIL-P-16232 TYPE M, CLASS 1, EXCEPT THAT THE ROLLER PATHS AND THE ROLLERS SHALL BE UNCOATED.

2.3 OUTLINE: DIMENSIONS AND TOLERANCES AT AN AMBIENT TEMPERATURE OF 68°F SHALL BE PER NAVORD DRAWING NUMBER 2890370.

2.4 BEARING HARDNESS: SUPPLIER DETERMINED EXCEPT FOR GEARTEETH WHICH SHALL BE RC 30-34.

2.5 BEARING CONFIGURATION: X-TYPE ROLLER BEARINGS WITH ONE TO ONE (1:1) ROLLER CONFIGURATION UTILIZING PLUG LOADING TO PERMIT SOLID RACES.

2.6 LUBRICATION: PRELUBRICATE BEARING AND OUTER RACES ALL OVER BEFORE DELIVERY WITH GREASE CONFORMING TO MIL-G-23827.

2.7 DESIGN REQUIREMENTS:

2.7.1 BEARING LOADS: THE BEARING SHALL BE CAPABLE OF WITHSTANDING THE FOLLOWING LOADS INDIVIDUALLY AND IN TOTAL COMBINATION.

2.7.1.1 NORMAL OPERATION:

1)	THRUST	41,100	POUNDS COMPRESSION
		17,600	POUNDS SEPARATION
2)	RADIAL	42,200	POUNDS
3)	MOMENT	970,000	INCH-POUNDS

2.7.1.2 SEVERE OPERATION: BRINELLING SHALL BE MINIMIZED SUCH THAT PERMANENT DEFORMATION AFTER LOAD REMOVAL IS LESS THAN .001 INCH.

1)	THRUST	136,000	POUNDS COMPRESSION
		62,000	POUNDS SEPARATION
2)	RADIAL	134,000	POUNDS
3)	MOMENT	4,200,000	INCH-POUNDS

THIRD ANGLE PROJECTION	SIZE	CODE IDENT NO.	NAVORD DWG NO.
	A	10001	2890371
	SCALE NONE	REV B	SHEET 2

FORM NO. [illegible]

D6/015

2.7.1.3 SURVIVAL: BRINELLING SHALL BE MINIMIZED SUCH THAT PERMANENT DEFORMATION AFTER LOAD REMOVAL IS LESS THAN .004 INCH.

1)	THRUST	253,000	POUNDS COMPRESSION
		143,000	POUNDS SEPARATION
2)	RADIAL	201,000	POUNDS
3)	MOMENT	5,400,000	INCH-POUNDS

2.7.2 VIBRATION: THE BEARING SHALL WITHSTAND THE FOLLOWING VIBRATORY ACCELERATIONS WITH A 12,000 POUND LOAD LOCATED 22.0 INCHES ABOVE THE BEARING CENTERLINE, FOR A MINIMUM OF ONE (1) HOUR IN EACH OF THE X,Y, AND Z DIRECTIONS:

		7HZ	15HZ
1)	THRUST	±2.5G	±1.3G
2)	RADIAL	±5.0G	±1.3G
3)	MOMENT	±5.0G	±1.3G

2.7.3 STIFFNESS (MINIMUM):

1)	THRUST	$15(10)^6$	POUNDS/INCH
2)	RADIAL	$12(10)^6$	POUNDS/INCH
3)	MOMENT	$2400(10)^6$	INCH-POUNDS/RADIAN

2.7.4 PRELOAD: THE BEARING SHALL BE PRELOADED TO OBTAIN THE STIFFNESS SPECIFIED HEREIN WITHOUT ANY INITIAL PLAY.

2.7.5 MAXIMUM OPERATING SPEED: 14 RPM (OSCILLATING MOTION)

2.7.6 FRICTION: 200 FOOT-POUNDS MAXIMUM WITH 12,000 POUNDS AXIAL LOAD.

2.8 RELIABILITY:

2.8.1 OPERATING LIFE: 10,000 HOURS BASED ON ONE (1) RPM AT NORMAL OPERATING LOADS (SEE 2.7.1.1).

2.9 ENVIRONMENTAL: THE BEARING SHALL BE CAPABLE OF MEETING THE ENVIRONMENTAL REQUIREMENTS OF XWS 9772 FOR TOPSIDE EQUIPMENT, EXCEPT THAT THE VIBRATION REQUIREMENT AND SHOCK LOAD REQUIREMENT SHALL BE AS SPECIFIED HEREIN.

2.10 WORKMANSHIP: PER MIL-STD-454, REQUIREMENT 9.

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	A	10001	2890371
	SCALE NONE	REV A	SHEET 3

FORM NO. 46-0513 (1/70)

2.11 QUALITY ASSURANCE PROVISIONS:

2.11.1 GENERAL: QUALITY ASSURANCE PROVISIONS SHALL BE AS SPECIFIED HEREIN; THE SUPPLIER SHALL ESTABLISH A QUALITY PROGRAM IN ACCORDANCE WITH MIL-Q-9858.

2.11.2 RESPONSIBILITY FOR INSPECTION: THE SUPPLIER IS RESPONSIBLE FOR THE PERFORMANCE OF ALL INSPECTION REQUIREMENTS AS SPECIFIED HEREIN. EXCEPT AS OTHERWISE SPECIFIED THE SUPPLIER MAY UTILIZE HIS OWN FACILITIES OR ANY COMMERCIAL LABORATORY ACCEPTABLE TO THE PROCURING ACTIVITY. THE PROCURING ACTIVITY RESERVES THE RIGHT TO PERFORM ANY OF THE INSPECTIONS SET FORTH IN THIS DRAWING WHERE SUCH INSPECTIONS ARE DEEMED NECESSARY TO ASSURE SUPPLIES AND SERVICES CONFORM TO PRESCRIBED REQUIREMENTS.

2.11.3 CLASSIFICATION OF TESTS: THE INSPECTION AND TESTING OF BEARINGS SHALL BE CLASSIFIED AS FOLLOWS:

(a) QUALIFICATION TESTS (SEE 2.11.4)
(b) QUALITY CONFORMANCE INSPECTION (SEE 2.11.5)

2.11.4 QUALIFICATION TESTS: THE QUALIFICATION TESTS SHALL CONSIST OF ALL THE QUALITY CONFORMANCE INSPECTIONS SPECIFIED HEREIN AND THE FOLLOWING ADDITIONAL TESTS.

2.11.4.1 ENVIRONMENTAL: THE BEARING SHALL BE TESTED TO VERIFY TO NAVORD WS9772 EXCEPT THAT VIBRATION SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS SPECIFIED HEREIN AND THE HUMIDITY AND SALT SPRAY TESTS SPECIFIED IN WS9772 SHALL NOT BE PERFORMED.

2.11.4.2 SAMPLING: TO BE SPECIFIED IN THE CONTRACT OR PURCHASE ORDER.

2.11.5 QUALITY CONFORMANCE INSPECTION: QUALITY CONFORMANCE INSPECTION SHALL CONSIST OF THE EXAMINATIONS AND TESTS SPECIFIED IN 2.11.6.

2.11.5.1 INSPECTION DATA: ALL QUALITY CONFORMANCE INSPECTION DATA SHALL BE RECORDED AND A COPY SUBMITTED TO THE PROCURING ACTIVITY AT THE TIME OF BEARING DELIVERY.

2.11.5.2 COMPUTATION DATA: PRIOR TO THE START OF PRODUCTION THE SUPPLIER WILL SUBMIT TO THE PROCURING ACTIVITY FOR APPROVAL HIS COMPUTATIONS SUBSTANTIATING BEARING LOADS, STIFFNESS, AND RATED LIFE.

2.11.5.3 CERTIFICATE OF CONFORMANCE: THE SUPPLIER WILL SUBMIT A CERTIFICATE OF CONFOMANCE AT THE TIME OF BEARING DELIVERY, CERTIFYING BEARING CONFORMANCE TO THE REQUIREMENTS SPECIFIED HEREIN.

THIRD ANGLE PROJECTION	SIZE	CODE IDENT NO.	~~NAVORD DWG NO.~~
	A	10001	2890371
	SCALE NONE	REV C	SHEET 4

FORM NO. 46-0513 (1/70)

D64017

2.11.6 TEST METHODS:

2.11.6.1 EXAMINATIONS: THE BEARING SHALL BE EXAMINED TO VERIFY CONFORMANCE TO 2.3, 2.6, AND 2.10.

2.11.6.2 NON-DESTRUCTIVE TEST: THE BEARING RACES SHALL BE PENETRANT INSPECTED PER MIL-I-6866, TYPE II, METHOD B. THE BEARING ROLLERS SHALL BE MAGNETIC PARTICLE INSPECTED PER MIL-I-6868. INSPECTION SHALL BE CONDUCTED ON A STATISTICAL QUALITY CONTROL BASIS PER MIL-STD-105.

2.12 PREPARATION FOR DELIVERY: PREPARATION FOR DELIVERY SHALL BE IN ACCORDANCE WITH MIL-E-17555.

APPLICABLE DOCUMENTS:

MIL-D-1000
MIL-I-6866
MIL-I-6868
MIL-Q-9858
MIL-P-13232
MIL-E-17555
MIL-G-23827
MIL-STD-100A
MIL-STD-105
MIL-STD-454
NAVORD XWS 9772
NAVORD 2890370

THIRD ANGLE PROJECTION	SIZE	CODE IDENT NO.	NAVORD DWG NO.
	A	10001	2890371
	SCALE NONE	REV B	SHEET 5

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06/018